THE

ELECTRICAL REVIEW.

VOL. LXX. MAY 31, 1912. No. 1,801.

ELECTRICAL REVIEW.

Vol. LXX.] CONTENTS: May 31, 1912. [No. 1,801.

	Page
Ne Sutor Ultra Crepidam	869
The Diesel Engine	870
Electrical Engineers in India	870
Copper	870
Competition in Germany	870
A Royal Visit (*illus.*)	871
Correspondence :—	
Strikes in Australia	871
Street Lighting and Pole Construction	872
Proceedings of Institutions :—	
Illumination : Production, Calculation, Measurement ...	873
The Illumination of Printing Works by Electricity ...	874
Highland Water-Power (*illus.*)	874
Physical Society	875
The Diesel Engine from the User's Standpoint	876
New Electrical Devices, Fittings and Plant (*illus.*)	877
Legal	879
In Darkest Africa	881
Figures Indispensable to Municipal Electricity Supply Works	883
Copper Buying and Drawing : The Economy of the Draw-Bench	884
Business Notes	885
Notes	891
City Notes	893
Electric Tramway and Railway Traffic Returns	896
Stocks and Shares	896
Share List of Electrical Companies	897
Exports and Imports of Electrical Goods during April, 1912	899
Reviews	900
Melbourne Suburban Railway Electrification (*illus.*)	902
Combined Irrigation and Hydro-Electric Power Schemes ...	903
Improving the Light Distribution from Metallic-Filament Lamps (*illus.*)	904
The Engineer and the Clerk—A Study in Relative Values ...	905
Notes from India	905
Australian Tramway Companies and their Employés.—IV ...	906
Trade Statistics of Egypt, 1911	907
New Patents Applied For, 1912	908
Abstracts of Published Specifications	908
Contractors' Column ... ... Advertisement page	xxiv

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEKKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

Binding.—Subscribers' numbers bound, including case, for 4s. each volume.

Cases.—Cloth cases for Binding, 2s. 6d. each; post free, 2s. 9d.

Foreign Agents.—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOIVEAU AND CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill London, E.C.

NE SUTOR ULTRA CREPIDAM.

IN all departments of business there are certain items of information which are jealously withheld from public knowledge by those whose interests are affected, so far as they are able to do so; in some cases, however, especially in connection with tenders called for by municipal and other public bodies, the facts are recorded on the minutes of proceedings, and are thereby made known to all who care to investigate such matters. Thus the purity of municipal transactions is safeguarded. The questions whether, and to what extent, such information should be scattered broadcast by the organs of the various trades have often been discussed, but with no definite result, as it is usually found that opinion is divided on these points.

The attitude of the technical Press in dealing with the subject is naturally determined in this, as in other matters, by the requirements of its readers and the public welfare; it is obvious that no journal professing to serve the interests of any particular trade would consciously and wilfully publish information detrimental to those interests—such a proceeding would be akin to cutting its own throat—but it is not always easy to discriminate between what is, and what is not, conducive to the welfare of an industry.

When doubt arises in such cases, an Editor naturally turns for guidance to those whose interests are immediately concerned, and adopts that policy which appears to be most fully in accordance with the common good; expressions of opinion, therefore, on the part of those who have a right to speak, are always welcome. Sometimes, however, suggestions are received from others—those who are in no way affected by the issue at stake, and whose intrusion into matters with which they have no concern savours merely of over-assurance.

For example, we recently published the detailed results of tendering for a turbo-alternator—a practice which we have followed from the beginning, and to which no objection has ever hitherto been raised by anyone; we were surprised, therefore, to receive an intimation from a manufacturer of a certain class of *instruments*, that he considered this proceeding "detrimental to trade!" Surely, if any objection is to be taken to an old-established custom, it should come from those who are familiar with the subject, and not from one whose interests lie in a totally different direction—who, in fact, knows nothing about the matter.

As regards the merits of the case referred to, apart from the mode of its introduction, all who are interested in turbo-alternators—makers and users alike—are well aware that the mere statement of the price and output of such a machine by no means affords material for appraising its value; without a knowledge of the details of the specification to which it has been built—of the speed, the power factor, the temperature limit, the guaranteed efficiencies, &c.—it is impossible to form more than a rough comparison between

that machine and one of nominally similar size. In other words, the information is of value mainly, though not solely, to those who took part in the competition for the contract. The same applies to any machine or apparatus specially built according to a detailed specification.

In the case of such things, however, as are made to stock by the thousand and sold "off the shelf," the conditions are different. Everyone then knows precisely what is being sold and can compare the prices to a penny. When this is the case, it may be argued that such knowledge may be misapplied, but even amongst those most intimately concerned with such matters, there will be found to be considerable diversity of opinion.

The Diesel Engine.

Now that the oil engine is so much in the minds of laymen and of engineers alike, the paper which is printed in abstract in another column may not come amiss, although it contains little which has not been recorded previously by users of the Diesel engine. Mr. Sowter's testimony is that of an unbiased station engineer, who has had personal experience of the various types of plant with which he deals, and it is evident that he has been impressed favourably by the Diesel engine for central-station work, as he is backing his opinion by installing another, and a larger set. Nevertheless, we are not prepared to follow him quite so far as he would take us, as his comparison of the Diesel engine with the gas engine is not sufficiently convincing. The paper would have been more valuable to the prospective purchasers of a prime mover if the author had confined his comparisons entirely to gas and Diesel engines, or had compared steam, gas, and Diesel engines under every heading. As it is, he compares the Diesel engine with a steam engine only here, and with a gas engine only there, with the result that the gas engine, perhaps, does not receive quite fair treatment.

Rightly enough, Mr. Sowter emphasises the necessity for highly skilled and even specialised attendance, as the Diesel engine, although so simple in appearance, depends so entirely upon internal cleanliness and the accuracy of delicate adjustments and clearances, that the type of man who can be trusted with the sole management of a small suction-gas producer and engine, might be a source of catastrophe if put in charge of a Diesel plant of equal power.

The enormous expansion of the Diesel business proves that the popularity and usefulness of this system is not the result of mere interested boosting; and, although the casualties during development are said to have been frequent and serious, there is no reason to suppose that the engine is not now as reliable as the gas engine, which, in its own childhood, had to endure many calamities.

Electrical Engineers in India.

Following upon our recent references to the need for a local section of the Institution of Electrical Engineers in Canada, comes an appeal from a member away in India who keenly feels the lack of facilities for conferring with fellow members in that part of the world. There is, of course, a Calcutta branch, but seemingly the difficulties in the way of holding sufficiently large gatherings have been great, for, reading between the lines of our correspondent's letter, we assume that there has been no effort made to hold a meeting for a long while. Yet it is thought that there are quite 25 or 30 members in Calcutta and many more in other parts of India who ought occasionally to gladly respond to an invitation to confer together. The present outlook has not much of encouragement in it for those who desire to so foregather, for the local honorary secretary, a Government official, who was formerly located in Calcutta, has now, it is said, been permanently transferred to Delhi, the new capital, whence it is hardly likely that he will be able to convene Calcutta meetings.

We recall at least one very useful paper that was read some years ago before a Calcutta I.E.E. meeting, on the packing of electrical instruments for export to India, and in another part of this issue, our Indian correspondent mentions a subject of considerable local interest (in regard to the effect of extremes of temperature upon batteries), such as might advantageously be discussed together by men who are frequently confronted with the problem on the spot. Perhaps the Institution may be able to do something more than it has hitherto succeeded in doing on behalf of the member abroad—though, if there is not sufficient enthusiasm in Calcutta to continue meetings when once they have been started, we do not know that much can be done from the headquarters in London.

Copper.

Messrs. Merton's circular shows an unusually large withdrawal from stock for the fortnight ending May 15th. The visible supplies at that date stood at 46,163 tons (for Europe), a reduction of 3,608 tons on the return for the end of April. This is made up of a reduction in English stocks of 1,934 tons, a reduction in quantity afloat from Chile of 675 tons, and a reduction in the quantity afloat from Australia of 600 tons. Rotterdam stocks are less by 250 tons, Hamburg by 492, and French stocks by 399 tons. The supplies from North America were below average, Spain and Portugal distinctly low, shipments from Chile very low, but Australia rather above average (half-monthly returns). The deliveries were low at 18,842 tons. The situation thus tends to higher prices, which, it is rumoured (says the *Financier* of May 18th), are assisted by large forward sales induced by fresh American advices. From the same source we note that the total consumption in Europe has advanced from 393,052 tons in 1909-10 to 497,602 tons in 1910-11, and to 510,597 tons in the past 12 months. The increase on consumption is, therefore, 117,000 tons. The increase in European supplies has, however, only amounted to 23,000 tons in the two years.

The large increase in consumption is attributed to active trade, especially in the electrical industries and ship-building. While this conclusion would appear a perfectly fair one, it will be interesting to see if the activity is maintained in the face of continuous "hold-ups" of national industry.

Turning to countries where the commercial conditions, if a little less modern, are, at any rate, not constantly changing for the worse, we find that Russia, while largely increasing her output of copper, is absorbing practically as much as she mines. The result of the equalisation of the two factors (as noted in an article in the *Financier* for May 21st), is that the market for copper from other sources becomes more limited.

Competition in Germany.

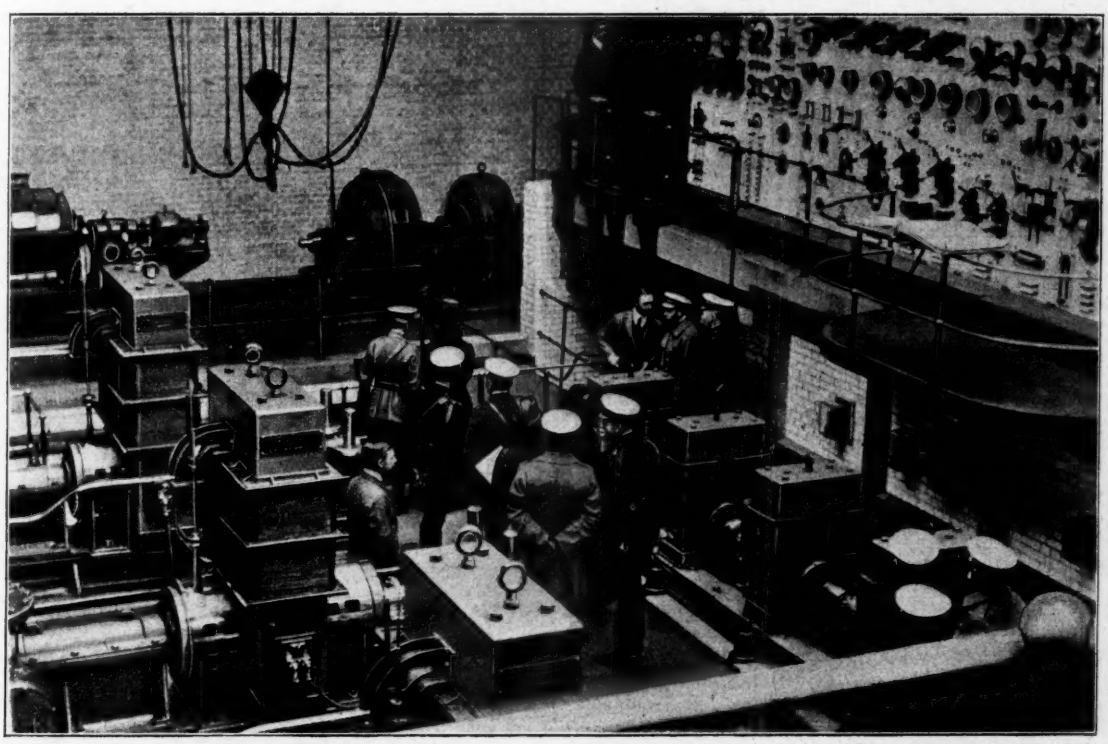
The recent meeting of the Bergmann Electricity Works Co., in which the Siemens-Schuckert Works Co. has acquired a large financial interest, was enlightened by Herr von Gwinner, general director of the Deutsche Bank, as to the events leading up to this transaction and the relations existing between the two companies. The director stated that there had been several possibilities of overcoming the ruinous trade competition which had prevailed in the electrical industry through the fault of the Bergmann Co. Either a kind of syndicate could have been formed by the large firms, or the Bergmann Co. could have become associated with one of the leading concerns. The transaction was finally concluded with the Siemens-Schuckert Co., because the latter had demanded the least. The present relations between the two were a kind of syndicate relationship for the prevention of mutual competition of a ruinous character, but it could only be lasting if the other electrical undertakings would join it. Herr Gwinner added that the electrical industry need not be ashamed of forming a syndicate in an age when the Prussian State belongs both to the Potash Syndicate and the Rhenish-Westphalian Coal Syndicate. If, then, these statements represent the opinions of the banking world, it is considered that the question of a syndicate or electrical trust will assume definite shape sooner or later.

A ROYAL VISIT.

A VISIT was paid by their Majesties, the King and Queen, on May 17th, to the Aldershot power station, which was described and illustrated in the ELECTRICAL REVIEW of May 29th, 1903.

The visitors, who were accompanied by General Sir John French and Lieut.-General Sir Douglas Haig, were received by the officer in charge of the electricity department, and Mr. A. J. Mayne, the chief electrical engineer, who explained to his Majesty the technical features of interest in the installation. A complete tour was made of the power station, which since we described it has been extended in order to supply the more distant parts of the camp.

The generating plant consists of three 250-KW. direct-current sets, one 100-KW. set, and one 319 K.V.A. extra-H.T. alternator (turbo-generators), with two motor-generators of 150 KW. The direct-current plant supplies light and power to Aldershot proper, that is Stanhope and Marlborough Lines, and a portion of Wellington Lines, while the alternating plant supplies light and power to Ewshott, Deepcut, Blackdown, the Royal Pavilion, and the Royal Aircraft Factory; the last-named takes power in bulk, being a large consumer. Since its installation the station has supplied electrical power to a very large number of places in the garrison which formerly employed steam. The Mechanical Transport Depôt is a big consumer, running all its machinery by electrical power, as also do the Field Stores and Ordnance Workshops, the R.E. Lands yard, with their big sawing and other plant, the R.E. workshops, the Headquarters' Printing Office, &c. The extent of the supply can be gauged from the fact that last year something like two and a quarter million units were generated, a remarkable figure for a station of its size. It is run on a thorough business basis, and affords an eloquent testimony to the up-to-date methods of the present-day military administration.



KING GEORGE INSPECTING ALDERSHOT ELECTRIC POWER STATION.

Walsall Electric Lighting.—The T.C. has applied to the L.G.B. for a loan of £10,000 for meters, services, mains, and additions to plant.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Strikes in Australia.

Your leaders in your issues of March 8th and 15th with reference to the coal strike and compulsory arbitration, are of special interest to us here in Australia, inasmuch as we live in a perpetual atmosphere of strikes, in spite of Arbitration Acts, Wages Boards and similar enactments, and especially are we subject to coal strikes of varying dimensions. Coal miners in N.S.W. are paid by piecework at so much per ton of coal hewn, the hewing rate being on a sliding scale based on the selling price. The selling price is controlled, or was until lately, by a combine known as "The Vend," and has not varied very much for some years. Local strikes, that is to say, strikes confined to one mine, are frequently attributable to causes which in themselves border on the ludicrous. For instance, quite recently a mine was held up for some days because the wheelers objected to work with a certain horse; on another occasion a wheeler getting extra annoyed with his horse, seized a pick and drove it some inches into the horse's rump; the wheeler was promptly sacked by the manager, and his mates equally promptly refused to go to work until the offender was reinstated. The manager retorted by prosecuting the offending wheeler, and secured his detention in H.M. gaol for a month, and the strike only lasted 10 days. We have elaborate Arbitration and Conciliation Acts, Wages Boards, Industrial Courts, and all sorts of legal paraphernalia with the avowed object of preventing strikes, and all are abortive, largely for the reason that they are very one-sided in operation. The Trade Unions, collectively and individually, have no idea of keeping their side of a bargain. There is, perhaps, a trade dispute on a question of wages; a Wages Board is appointed, and duly delivers an award, which award is theoretically binding equally on both parties to the dispute, but actually it is only binding on the employers, as being few in number, and being men of substance, they can be prosecuted and fined for a breach of the award, but the Unions simply flout the

award unless it gives them exactly the terms they originally demanded.

The most trivial matter seems sufficient cause for a strike, as was seen in the recent strike in Brisbane. It commenced with a dispute as to whether the tramcar drivers and conductors should be allowed, when in uniform, to wear openly a badge indicating that they belonged to a Trade Union; the general manager of the tramway company naturally objected to having invidious distinctions made, but agreed that, as several other matters were to be submitted to the Arbitration Court, this question should also be included. The tramway men not being satisfied with this decided to go on strike. Finding themselves being beaten they induced the Trades Hall officials to declare a general strike, forcing everyone in Brisbane, and virtually in Queensland, to participate in a dispute over such a trifling matter as to whether a certain small number of men should or should not be allowed to display an enamelled button. On finding that employers did not, as they had anticipated, immediately capitulate, the strikers, as usual, resorted to violence. But Brisbane, fortunately, had a strong man as Police Commissioner, and a Government with a backbone behind him, and the strikers were met in a determined manner by a strong body of police and special constables.

Processions were absolutely forbidden, and public meetings and inflammatory speeches stopped, and the strike immediately began to fizzle out. The employers' executive assisted materially in making the general strike abortive by refusing to meet the strike leaders in conference. They said truthfully that they were not aware of any trade dispute in which they were concerned, and, consequently, there was nothing to confer about. In the meantime, the tramcar service, though decreased, had never actually ceased, and it continued to improve. Finally, the trade unions by contriving to get a similar dispute as to badges raised on the Adelaide tramway system managed to get the whole matter taken out of the State jurisdiction and brought before the Federal Arbitration Court, the Judge of which has been particularly kindly disposed to the labour side of the question, so much so, in fact, that the trade union officials strain every nerve to make any dispute extend over more than one State, so that the matter can be brought before the Federal Court. The result was as anticipated, and an award was promulgated permitting the tramway men to wear the much discussed badge, and the general strike was declared off (some time after it had been actually dead as mutton). Unfortunately for the tramway men it proved a very barren victory, as, though the Court had given permission for them to wear badges during their hours of labour, they found that they no longer had any hours of labour, as their places had mostly been filled by others who were indifferent on the subject of badges. On a recent visit to Brisbane I travelled a good deal on the cars, but though I looked carefully I did not see a badge.

A strike at Lithgow Ironworks, which has been going on for many months, arose over the dismissal of a man for absenting himself from duty without permission or giving notice; this strike involved directly some 4,000 to 5,000 men, and indirectly many others. The Mount Zeehan strike, which also extended over a long period, was due also to the dismissal of two men; and the Australian Gas Co.'s strike arose from a similar cause. A strike involving the whole of the southern collieries and lasting many weeks was caused primarily by two union men refusing to pay fines which they considered had been unjustly levied by their union. The union demanded their dismissal, and because the mine manager refused to be a party to the dispute, the mine in question closed down, and eventually the whole of the southern mines followed suit, and the northern and western mines were also drawn into the matter. Usually when strikes of such magnitude occur, the primary cause becomes lost in obscurity, as the occasion is seized to make further demands.

The Sydney tramway strike was caused by the dismissal of a conductor found guilty of diverting fares into his own pocket.

One can sympathise with a body of underpaid men striking with the object of getting a fair remuneration for their labour, or to get better working conditions or shorter hours of labour, but such pitiful excuses for striking as we have had experience of lately in Australia, amount to prostitution of an otherwise worthy organisation and a tyrannical misuse of power.

The minimum wage has been adopted here to the limit, and though the principle appears reasonable, the practice works out badly, mainly due to the fact that the minimum is placed too high. A good tradesman can always command good wages, irrespective of the minimum, but the trouble arises from the fact that the poor or indifferent workman wants the minimum put at such a rate that he also can earn as good wages as a skilled man; further, the minimum is constantly on the increase, with a levelling-down in the amount of work executed per man. If the minimum wage is put at such a rate that an employer has to pay more for an indifferent workman than he should do, he has to balance things by paying less to the good man, that is to say, the minimum becomes the standard wage. If, for example, the standard rate is 10s. per day, then the minimum should be placed at not higher than 7s. 6d. per day, giving an employer a chance to grade men according to their worth. There are plenty of men who know that they are not worth the standard wage, and are quite content to work for less, but under the high minimum standards adopted here, such men find it extremely difficult to get any work at all, as whoever employs them is compelled by law to pay them more than they are worth. In some instances it is permissible to class a man as a "slow worker," and pay him lower wages than the minimum, but the power of granting such permits is placed in the hands of the secretaries or other officials of the unions, and the permit is very very rarely granted, with the result that many men have been forced into the asylums.

Australia, with its Labour Governments, controlled and directed by the Trades Hall, short hours of labour, minimum wages, courts which continually grant preference to Unionists, compulsory Arbitration Courts which are only compulsory on the employers, and shortage of labour, is the Paradise of the *Unionist working man*. The non-unionist is hardly recognised as a human being, and he is not considered as having a right to live.

Arthur C. F. Webb.

Sydney, *April 17th*, 1912.

Street Lighting, and Pole Construction.

I saw in your paper some few months ago that Aberdeen were experimenting with metallic-filament lamps suspended from tramway span wires. At the time of reading the information, we had already had some four months with this, which, I believe, is a new form of suspension. All the side streets and less important streets in Ballarat are gas lit. Owing to the exceptional width of our streets here, and the fact that the majority of the roads have avenues of trees down them, lighting by gas lamps positioned on the pathway is a difficult problem, and the results far from satisfactory (our main streets are 200 ft. wide, and our side streets 99 ft.). By positioning the lamps centrally over the road, and also at street intersections a very satisfactory form of street lighting has been obtained. We use 50 and 100-C.P. Pope lamps with enamelled white shades of parabolic shape for throwing out the rays to a far distance. In the case of tramway span-wire construction, the lamp fitting is clamped on to the span-wire about 18 in. from the trolley wire, and at intersections special span wires are run for the suspension of same. I anticipated we might be troubled with the lamps fracturing owing to the amount of vibration and movement on the lamps. This has not been our experience. The first experimental section have been up some eight months, and the fractured lamps have been remarkably few. The Pope lamp is a mechanically strong one, and I have every reason to believe we shall obtain a life similar to that in lamps burning under normal conditions.

Pole Construction.—I was interested in reading the articles in your paper entitled "Wood and Concrete Poles in Electric Service," by Mr. W. Manktelow, on February 2nd last. It may interest your readers to hear of a combined wood and concrete pole, the invention of a local resident in this town. We have a number of these poles in use for arc lighting purposes, which have been up some five years, and

the Postal and Telegraph Department have been experimenting with these as well. We are at the present time erecting some more of them. I can, perhaps, describe these best by sending you the enclosed pamphlet, which gives an illustrated description of these poles and copies of tests that have been made on them.

P. J. Pringle,
Engineer and General Manager.
The Electric Supply Co. of Victoria, Ltd.

Ballarat, *April 23rd*, 1912.

[The suspension referred to by Mr. Pringle has given very satisfactory results at Barrow-in-Furness, where it was introduced by Mr. H. B. Burnett (see Electrical Review, May 3rd, 1912). A description of the composite pole appears elsewhere in this issue.—Eds. E.R.]

PROCEEDINGS OF INSTITUTIONS.

Illumination: Production, Calculation, Measurement.

By J. D. Mackenzie.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Glasgow, March 19th*, 1912.)

The function of all light is to make visible; to illuminate surrounding objects so as to excite the visual faculties of the onlooker. The advent of the metallic-filament lamp has caused the general use of larger units and more brilliant illumination. Whether this is or is not a matter for unalloyed satisfaction, the intensely brilliant light sources now at our disposal should only be applied where there is a knowledge of illuminating engineering to arrange them properly and offset the obvious disadvantages attending their use. There is no doubt that the alarming increase in ophthalmic complaints is to a certain extent due to improper lighting arrangements.

We come far short of the possible efficiency in light production. When it only requires 0·05 to 0·1 watt per candle-power to produce light, the tungsten lamp giving 1 c.p. per 1·25 watts, has only a possible efficiency of 4 to 8 per cent. The attainment of very much higher efficiencies from incandescent solids is scarcely to be expected owing to the long range of invisible heat vibrations at the one end and invisible ultraviolet vibrations at the other end of the spectrum. Tests of the light efficiencies for the mercury arc give values from 5·8 to 17·6 per cent. The fire-fly and glow-worm have a lighting efficiency of practically 100 per cent., and the production of light with an efficiency approaching this figure is the problem still awaiting solution.

For interior lighting, the maximum candle-power should be obtained at an angle of about 45° on each side of the vertical. For lighting of streets and open spaces, the maximum should be at about 10° to 20° from the horizontal. To direct the maximum light rays in the desired direction is the purpose of reflecting shades and refracting globes, such as the Holophane globes, and it is possible, by the correct use of these devices, to obtain any required result, and to modify an unsuitable polar curve into a useful and effective one. One point essentially necessary is that all light sources should be screened from direct vision. This should preferably be done by enclosing globes or white backing reflectors which do not unduly absorb the light. The eye adjusts itself to the brightest spot in the field of view, and if this bears a great disproportion to the minimum illumination (that is, if the diversity factor is very large) the iris opening may not be great enough to permit of proper vision. An apparent gain in illumination is obtained by substituting an obscured lamp of the same candle-power for a clear one. One-third of the light flux may be absorbed in passing through the glass in the obscured lamp, and still the increased pupil area enables one to obtain a better visual effect than with the clear one. An important point is that all such articles as the Holophane globes and reflecting shades should be readily accessible for cleaning purposes; a very little dust will make a very great difference to the resulting illumination.

There is still much necessity for a properly designed inner globe for arc lamps. A reduction in the luminous intensity at angles up to 20° from the vertical, and throwing the maximum intensity at an angle of about 80° from the vertical, would result in a decreased height of lamp with a more uniform illumination. At the same time, intense light sources, such as arc lamps, should not be placed too low. With an arc lamp placed at a height of 20 ft. from the ground, the direct rays reaching the eye of the man about average height would be from 5 to 16 times the horizontal illumination at the same place. Hence it follows that high-power sources should be placed well up out of the range of ordinary vision. This is where the advocates of low-power sources, placed at moderate heights and spaced more closely, score.

The table gives a series of values obtained in gas and electrically-lighted streets in Glasgow, from which you will notice that some of the values obtained are very low, and indicate what is the usual standard obtained in ordinary gas-lighted thoroughfares. The readings were taken with the Trotter standard photometer made by Messrs. Everett, Edgcumbe & Co. It is a matter for surprise that there are so very few thoroughfares lighted by lamps placed centrally. Lamps suspended from steel cables stretched across the streets are quite common in Continental cities, and give a very fine lighting effect. There is a good deal to be said in favour of this method of lighting; the footpaths are left quite unhampered, and the roadway is also quite clear of any objectionable posts with the accompanying islands of concrete surrounding them. And the roadway is nowadays the part most requiring illumination. The large increase in fast vehicular traffic on main thoroughfares in our cities demands more and better illumination, and therefore, instead of having values of the order 0·01 ft.-candle at the centre of a roadway, it ought to be at least 10 times that amount. The principal objection probably to suspended lamps is the difficulty of cleaning and trimming, but this can easily be overcome.

Illuminant.	Distance.	Hor. illumination.	Direct illumination.	Calculated equiv.
Single vertical gas mantle on post approximately 10 feet high (street without much traffic).	39 ft.	—	·01	16 c.p.
	19½ ft	—	·06	25 c.p.
	10 ft.	·05	·14	20 c.p.
Double vertical gas mantle (busy main thoroughfare).	40 ft.	·005	·03	48 c.p.
	30 ft.	·01	—	—
	20 ft.	·05	—	—
	10 ft.	·21	·425	63 c.p.
Single 100-c.p. m.f. lamps with reflectors (as above).	33 ft.	·01	·07	78 c.p.
	26½ ft.	·1	·28	89 c.p.
	9 ft.	·39	·625	80 c.p.

There is one point affecting street lighting which ought to come within the statutory powers of municipal and burgh authorities; that is the right to regulate the intensity of outside illumination provided by shopkeepers for their business purposes. The author would suggest that a limit should be placed on the maximum illumination.

A very simple method of suspending street-lighting fittings over the roadway has been developed by Mr. H. B. Burnett, the electrical engineer for the County Borough of Barrow-in-Furness, and is peculiarly applicable in the case of lighting required along tramway routes.*

While the calculation of illumination is generally a very tedious operation, the measurement has been made a very simple matter. A great deal of ingenuity has been expended on the design and construction of portable instruments, and the uses of such are obvious. If a complaint is received by the electricity department that a consumer cannot read his evening paper owing to the poor supply given in the evening, it is quite a simple matter for the illumination expert of the department to set himself down for the time being on the complainer's chair and take an illumination reading. If he is wise, and has provided himself with a new lamp to substitute in the electric fitting he may be able, by taking a second reading, to prove that the lamps are old and ready to perish, and that the supply is all in order. To the canvasser and the contractor such an instrument should be a valuable aid. A reading taken with the existing lighting compared with a value likely to be obtained with the suggested improvement would go far towards convincing a wavering client. As to the measurement of illumination on streets and open spaces, it is evident that if a screen is placed horizontally it will receive illumination from all the sources in the neighbourhood, and hence it gives a measure of the total illumination. The "Westminster" method of measuring street lighting is by taking two readings with the screen pointing directly to the source of light and at angles of 20° and 50° from the horizontal.

The human eye takes in a very wide field, and the visual effect is not measured by either of those methods. I think that a visual effect photometer could be constructed having a lens of approximately equal field to the human eye, receiving light from all the sources in the field of vision and illuminating a screen which could be balanced against a known illumination. This would give, I think, a more accurate idea of street illumination than any photometer at present on the market.

Discussion.

Mr. S. Z. de Ferranti said Mr. Mackenzie had shown them the wonderful possibilities there still were in the way of improving the efficiency of a light-giving source, especially in lamps. Notwithstanding this, it was a very doubtful question how far it was desirable to improve the efficiency of illumination. They might be paying too dearly for this increased efficiency. At present the price of electrical energy was nothing like a reasonable value. What they wanted was something as nearly approaching sunlight as possible, and if that was less costly, as it probably would be in time, that was the form of lighting that the public would want because it suited them best. They might have to look for the equivalent, the higher equivalent of efficiency, in the cheaper supply of energy, and he thought that would be brought about in a much greater degree as time passed. It was very different with gas, which had very much settled down upon what might be termed bed-rock prices, while with electricity this was not so. The cost might not drop to any great extent, but nothing had yet been done with by-

* The author's description of this system was reproduced in our issue of May 3rd, page 734.—Eds. E.R.

products recovery. That went to show that without any increase in the efficiency of the light source itself, they might have electric light at an immensely lower price than it stood at to-day.

Mr. W. W. Lackie thought Mr. Mackenzie was wrong in what he said about the increasing amount of ophthalmic cases. This increase was only apparent because it was shown as the result of medical examination of school children and others. He did not agree that they should object to people putting arc lamps along the outside of their premises. They would never get a glare from arc lamps that would be greater than the glare of the sun. There had been great advances in street lighting recently.

Mr. Robertson (Greenock) said that the subject was one which had not received anything like the attention it ought to, and that was largely owing to the fact that most electrical contractors fell into the practice set by gas before their time. In Glasgow they found naked metal-filament lamps in a row in shop windows. With gas they concealed the lamps in a window behind a screen and saw the goods to the best advantage and without any strain to the sight. In house lighting the same thing prevailed. It was thought the proper thing to hang the light in the centre of the room, with the light 8 or 10 ft. from the floor; the right way was to illuminate the ceiling with lamps concealed in glass bowls or reflectors. They often found that the architect knew little about the fitting-up of a building with electric light; he was more concerned with the appearance of the place than with the lighting effect. The whole principle upon which architects proceeded in illuminating buildings was erroneous. Now they were up against keener competition in street lighting through high-pressure gas lighting, which was no doubt a very strong competitor. With ordinary pressures they had not much to fear with the latest metal-filament lamps. He was quite at one with Mr. Mackenzie in desiring some regulation in the shop-lighting by shopkeepers outside their premises. This was becoming something of an evil, and the authorities would have to deal with it.

Mr. McWhirter said he was forced to the conclusion that the question of proper installation and distribution of illumination was one of the most exacting sciences they had to deal with.

Mr. J. S. Nicholson agreed that it was a most important thing to isolate as much light as possible in shop windows from the eyes.

Mr. Mackenzie, in reply, said the President spoke about the ideal light as one which would approach nearest to sunlight, but suggested that it would be more costly; he thought, however, it would be cheaper in the end, for the human eye was more accustomed to sunlight, and there was a factor acting upon the visual nerves at the point where the yellow waves at their maximum approached to sunlight. That was the very light which, if they could get it, and get rid of the reds above and below it, would give them the best and cheapest form of lighting. He agreed with Mr. Robertson's remarks about concealed lighting for shops and houses, with the remarks made about the planning of lighting schemes by architects.

The Illumination of Printing Works by Electricity.

By Justus Eck, M.A., M.I.E.E.

(Abstract of paper read before the Illuminating Engineering Society, *on March 19th,* 1912).

The object of this paper is to give some indication of the requirements of the industry and to endeavour to find the most economical method of dealing with them.

The measurements given in the paper are mostly taken in newspaper printing works where the work is mostly done at night, and where time is the very essence of the business. Other important factors have to be considered, such as safety both to the person and against fire, absence of heat and moisture, non-contamination of the air, freedom from glare, ease of supervision of machines and operatives, correctness of colour-discrimination, and absence of eye-strain, but in many cases other factors have militated against proper consideration being given to them. In the hand-composing room, increased illumination without glare or perceptible increase in the air temperature had not only resulted in more rapid output, but also in improvement in the eyesight of the compositors. One important printing firm stated that they had not only decreased their lighting bill this year by over £500, but they had contemporaneously increased their output by nearly 40 per cent. Linotype machines require a good illumination on the copy, less on the key-board, and a very powerful illumination on the matrices just before they reach the casting-box, for which purpose an adjustable lamp is brought to within a few inches of the matrix receptacle, a method of lighting which seems to me to be capable of improvement by means of a suitably-designed reflector. Average values were: matrix box, 25 foot-candles; copy, 8.3; keyboard, 4.3.

For Monotype machines a considerably lower illumination is usually provided: copy, 5.4; keyboard, 3.7; instructions, 4.2.

On the Monotype casting machines the averages were: type-face, 2.75; reel-face, 3.9; galley bench, 6.0 ft. candles.

With the skilled compositor the selecting of the type is largely automatic, the operation requiring most light being the reading of partially illegible matter and the checking of the set-up work. The cases of type in use are generally placed: One, more distant, on the slant, and one horizontal, or at a less angle, close to the compositor; when glow lamps were used, one lamp per man was usually the allowance. On slanting cases the average with glow lamps was 7·4 ft. candles; with inverted arc lamps 6·8, and with mercury vapour lamps 4·7, while on the horizontal case the figures were 5·3 10·5 and 7·3 respectively.

In the composing room many other operations besides typesetting are conducted, such as the assembly of advertisements and miscellaneous matter on horizontal tables called random benches, and the finished work is assembled in formes ready for passing to the press or casting room.

On random benches the average illumination was about 7 ft. candles, and on imposing benches 6½.

For the purpose of comparing the efficiency of illumination over an area, the number of watts per foot-candle measured at a standard height on a horizontal surface per sq. ft. has been taken. Values found were for glow lamps ·35, for inverted arcs ·24, and for mercury vapour lamps ·3 watts per foot-candle per sq. ft. It is only necessary to multiply this by the area in square feet and the average number of foot-candles required, to obtain as a product the watt consumption.

To arrive at the actual cost per hour, the figure must be multiplied by the cost per watt-hour, to which must be added the depreciation and repair cost per hour, together with, in the case of arc lamps, the cost of carbons and trimming, and in the case of metal-filament lamps, the cost of renewals and cleaning. These figures cannot be stated except for individual cases, but they may be taken to be in proportion to the watt consumption.

In some composing-rooms using metal-filament lamps improvements were in hand in the direction of using Holophane or similar prismatic directive glass shades.

Actual measurements of the improvements effected by the prismatic glass reflectors were made:—

	Ord shade.	*Holophane.*
1. *Make-up table* ...	Average ft.-candles, 4·8	8·0

These measurements are the mean result obtained upon the same table with the same lamps fixed at the same heights.

2. *Random table.*	*Lamps* 1.	*Between lamps.*	*Lamps* 2.	*Between lamps.*	*Lamps* 3.
(*a*) Ordinary shade	17	3·4	11	4	13
(*b*) Holophane ,,	7·0	6·0	7·0	6·0	7·0

In case (*a*) there were three lamps in the row, while in case (*b*) there were only two lamps, so that, with a far more even and quite sufficient illumination, slightly more than half the number of lamps in a long row would be required; in this case there was an actual saving of 33⅓ per cent. in the energy consumption.

3. *Examining tables.*	*Ord. shade.*	*Holophane.*
Max. ft.-candles	8·0	9·2
Average ,, ...	5·2	8·0
Minimum ,, ...	2·1	6·8

In this case the energy consumption was the same, but the mean illumination was raised by the prismatic shades to the maximum before obtained, whilst the minimum was improved over threefold. Similar improvements were in another case obtained by the employment of the Benjamin steel reflectors.

For high-speed rotary presses powerful lamps giving good diffused general illumination are preferred, aided in the interior of the press by additional lighting, usually obtained from one or two carbon-filament lamps.

It may be taken that not less than 2½-ft. candles is anywhere satisfactory for a high-speed rotary press.

Flat-bed presses require an average illumination of about 5-ft. candles on the working plane.

Presses for two and three-colour work need not only a good illumination of not less than 5-ft. candles, but attention must be paid to the spectrum of light resulting from the source used, in order to obtain the best results.

In large despatching rooms the efficiency was 0·3 watt per ft.-candle per sq. ft., with an average illumination on floor of 2·1 ft.-candles.

In most places I have visited and measured there is room for improvement, which would in some cases take the aspect of a saving of current, and in other cases of rendering the illumination more even and in accordance with the requirements of the average user, thus producing better and greater output in a shorter time. Many operatives working with an ample supply of indirect lighting, approximately white, have found their eyesight improve to such an extent as to enable them to discard their spectacles.

Highland Water Power.

In a paper recently read before the Inverness Field Club, by Mr. A. Newlands, M.Inst. C.E., on our sources of power, attention is drawn to the resources of the Highlands of the North and West of Scotland. No other part of the country, says the author, can offer equal possibilities.

This part of Scotland has the greatest extent of elevated area and the greatest rainfall, with the possible exception of Cumberland, in England. In many parts of Scotland the rainfall amounts to 60 in. per annum, and it has the further advantage that the rainfall is fairly uniform throughout the year. This maximum rainfall coincides as a rule with the areas of greatest elevation, and in these areas there are many fine natural reservoirs in the form of Highland lochs, with a rapid and short fall to the sea. A further advantage is that, particularly in the North and West Highlands, these drainage areas are all near the seaboard, which again is so indented and sheltered as to afford peculiar advantages for access by shipping, and the country generally is well served by railways and roads.

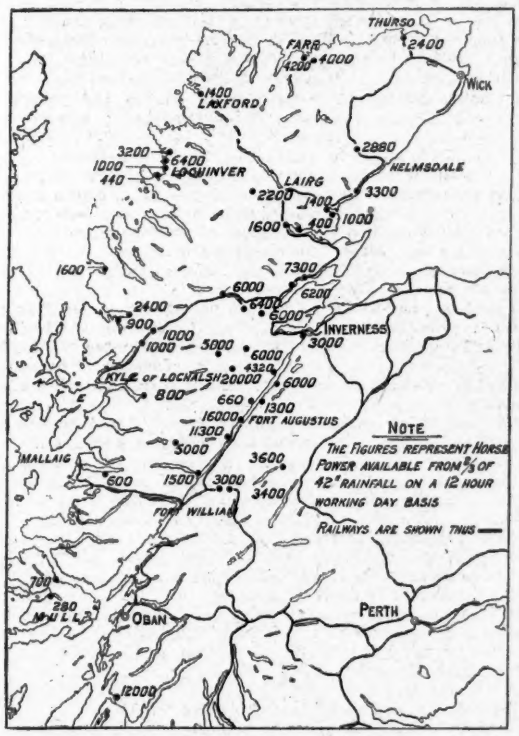
Already works have been installed at Foyers and Kinlochleven, the former developing 7,000 H.P. and the latter 30,000 H.P. Many smaller installations are scattered over the north and west.

To utilise the water power possibilities in the Highlands to the best advantage it is necessary that each entire drainage area should be developed up to its maximum output as one complete unit, for it is in the large installations that the maximum efficiency and economy is got.

The Kinlochleven installation shows what can be done by the application of this principle of generating in large units. The drainage area is the relatively small one of 55 sq. miles, but it had no natural reservoir within it, so that the expense of constructing a dam of a maximum height of 86 ft. and of a length of 1,037 yd. had to be faced. The reservoir, probably the largest artificial one in Europe, has a length of 7½ miles and an average width of about ½ mile. It impounds about 20,000 million gallons of water, sufficient to give an output of 30,000 H.P. for about 100 days. The cost of the work was £600,000, or equal to £20 per H.P.

With the exception of its high elevation (1,065 ft.) and heavy rainfall (70 in. per annum), the Kinlochleven area is not more favoured than many areas of greater extent throughout the West and North of Scotland, and in many of these the expense of a dam would be unnecessary, owing to the presence of natural reservoirs or lochs in most of them.

These power possibilities ought to be looked upon as a national asset, and as such should be developed by Government assistance, and probably this could best be done by the appointment of a Royal Commission to examine and report on them.



SOME UNDEVELOPED SCOTTISH WATER-POWERS.

Electric power from water has been publicly advertised for sale as low as 30s. per horse-power per annum. Probably the following figures from the ELECTRICAL REVIEW of a few years ago may be a fair comparison of the minimum cost of power from various sources:—

Electrical horse-power-year from water in Switzerland	£1	19	0
Steam in England	4	11	8
Blast-furnace gas in Germany	4	1	7
Producer gas in England	5	0	0

A comparatively recent estimate showed that the quantity of power obtainable from water in Great Britain amounted to about 1,000,000 H.P.

If the rainfall from its 700 square miles of drainage area were retained in Loch-Ness by controlling the overflow into the river, it would be possible, by utilising the Caledonian Canal as a flume or conduit, to convey the stored water to Inverness, to utilise it there for the development of 3,000 H.P. during the working days of the year, and yet supply sufficient water to the river to maintain its normal summer flow.

The Loch-Luichart drainage area is a very attractive one for power purposes. Its area is 149 square miles, and the loch has an area of 1·76 square miles, say, 1,150 acres. The river flows out of the loch in a series of cascades, and falls 125 ft. in a length of 850 yards. On a 75 per cent. efficiency, and dealing with half of a 42-in. rainfall as available for power, 1,580 H.P. on a 24-hour power day could be developed. This will be fully 3,000 H.P. for a working day, and even if no water flowed into the loch for six months a sufficient quantity of water could be stored to give this quantity of power for six months by raising the level of the loch 36 ft., and the water would all be returned to the river again within half-a-mile of the loch. The raising of the loch could be very easily done, as the outlet is through a narrow rocky gorge. The power could be taken to Inverness by a high-voltage transmission line. The cost of the necessary pipe lines, generating plant, buildings, and transmission line to Inverness, but excluding water rights and way-leave, would probably amount to £40,000. Even 1,000 H.P. used industrially would provide employment for 3,000 workers in Inverness, representing an increase in the population of probably 15,000 people, and with the fine facilities for shipping, and the abundance of open ground on both sides of the river mouth suitable for factory sites, and readily accessible by railway, the town is in an eminent degree suitable for such an industrial development.

The accompanying map may be found useful as indicating a number of localties where power is available, and the approximate amount of such power; it is in no sense a complete list.

The horse-power figures noted on the plan represent what is available for 12 hours' daily continuous working, it being assumed that it is possible to impound or store ⅔ of a 42-in. rainfall, the remaining ⅓ being reckoned as lost by evaporation and absorption in the ground, and any rainfall above 42 in. per annum being reckoned as lost in flooding or in compensation water to the rivers.

Scotland is estimated to possess 1,000,000 H.P. obtainable from water, and even if the figures be put at one-half that amount, this would represent an amount of power on a 10-hour working day basis throughout the year equal to that obtained from 3½ million tons of coal, which is about one-twelfth of the total quantity raised in Scotland for 1911, and of this quantity only a small proportion is converted into power.

Physical Society.

AT the meeting held on May 10th, a paper on "The Generation of Electricity by Carbon at High Temperatures," by DR. J. A. HARKER, F.R.S., and DR. G. W. C. KAYE, was read by Dr. Harker.

The experiments described owe their origin to some contamination phenomena which were encountered when tubes of refractory rare earths were baked in carbon-tube resistance furnaces at temperatures from 1,500° C. upwards. It was found that the tubes often had their outer surfaces carbonised to an appreciable depth, while the inner surfaces, though freely exposed, were much less attacked. The blackening was presumably caused by particles shot from the carbon walls of the furnace with velocity high enough to penetrate the refractory material after crossing a few millimetres of air at atmospheric pressure.

The preliminary experiments on the nature of these particles were carried out by the use of two insulated exploring electrodes of carbon inserted into an alternating-current furnace. They were connected externally to a battery of cells, and the potential-current curves were determined for the electrode gap in the furnace at a number of temperatures. No appreciable current could be detected at temperatures below about 1,400° C., but as the temperature rose it was found that quite small E.M.F.s gave rise to steady currents of relatively enormous magnitude. For example, with 8 volts, currents up to 10 amperes have been obtained at a temperature of about 2,500° C. The relation between current and temperature was found to be of an exponential character.

The magnitude of the currents made it evident that the atmosphere of the furnace was ionised to an unusual degree at high temperatures, and the authors were led to try the effect of temperature alone in the absence of any applied potential. Accordingly the battery was cut out, and while one of the electrodes remained stationary within the furnace the other could be suddenly displaced to a colder or hotter part of the furnace. The resulting difference of temperature manifested itself as a transient current in the circuit, which in some cases amounted to 2 amperes. The current died away when the two electrodes attained the same temperature.

In the apparatus shown the movable electrode was moved in and out of the hot region of the furnace by means of a clockwork mechanism. The pulsating electric current thus produced was large enough at high furnace temperatures to light up a nest of small glow lamps, the illumination waxing and waning as the movable electrode moved in and out. The experiment has been modified in later work by keeping both electrodes stationary and water cooling one of them. The cold electrode was made of a brass tube, which in some cases was provided with a carbon sleeve. A continuous current can thus be generated. Its direction is such as would be produced by a discharge of negative particles from the hot electrode. As before, no potential is applied. At the lower temperatures small positive currents have also been detected; at high temperatures negative currents up to nearly an ampere have been measured. The whole of the experiments were conducted at atmospheric pressure and almost entirely with low-voltage alternating current furnaces.

In reply to the discussion, DR. HARKER stated that the effect was not chiefly a chemical effect, as it was the same whether the gas in the furnace was H_2 or N_2, nor did it matter what the carbons were made of. Specially pure carbons gave phenomena of just the same order of magnitude.

DR. KAYE, in reply, stated that the feature which differentiated their experiments from others was that the effect occurred at atmospheric pressure and not *in vacuo*. It was hardly likely at this pressure that the effect could be confined to electrons, as the mean free path of such would be very small. The effect might be due to the transference of carbon itself, probably in ultra-microscopic particles and not molecules. When a cold tube was used for one of the electrodes it was found in half an hour to be coated with a deposit of carbon. There was no likelihood that the effect would

decay with the time, as it had been kept constant for over three hours. It was also not necessary to use electric heating in the furnace. Heating by Thermit and Méker gas furnaces gave the same results.

A paper by MR. S. BUTTERWORTH on "A Method of Measuring Small Inductances" was read by Mr. A. Campbell.

The author shows how Anderson's method may be modified so that, while still retaining the usual standards of capacity, very small inductances may be measured. The conditions of maximum sensibility are indicated and experimental results are quoted in which an inductance of 20 microhenries is compared with a capacity of 0·1 mfd.

A paper on "The Conversion of Starch into Dextrin by X-Rays," by H. A. COLWELL, M.B., and S. RUSS, D.Sc., was read by Dr. Russ.

The Diesel Engine from the User's Standpoint.

By WM. J. U. SOWTER, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Dublin, April 18th*, 1912.)

IT is the intention of the author to discuss the matter from the user's standpoint, quoting as far as possible results obtained in actual practice.

The quantity of cooling water required is considerably less than that required by suction-gas or steam plants. With an inlet temperature of 50° F. and an outlet temperature of 140° F., about three gallons per B.H.P. are required. Taking the case of a 250-B.H.P. engine, and assuming the loss due to evaporation and leakage to be 10 per cent., the cost of water at 6d. per 1,000 gallons will amount to 0·45d. per hour. It is apparent, therefore, that generating stations using Diesel engines can be located in populous districts, removed from rivers or canals, if a town water supply is available, and the cost of cooling water will be a negligible item. This may result in a considerable reduction of the cost of the distributing system.

The standard fuel is crude Texas or Roumanian oil, which may be purchased at prices ranging between 35s. and 70s. per ton, the price being lower near large ports. The oil can be purchased in London at about 40s. per ton, while in Bray (Co. Wicklow) the present price delivered into our tanks is 58s. 6d. per ton.

The following is a specification of a suitable oil which the author has adopted with satisfactory results :—

1. The oil shall be crude, refined, or a residue of petroleum.
2. It shall be free from tar, bitumen, or solid hydrocarbons, sand, fibrous matter, or foreign solid impurities.
3. The oil shall not contain more than one-half of 1 per cent. of water, nor 1½ per cent. of sulphur, and shall be free from acid.
4. The viscosity shall be such that the oil will flow in a continuous stream with 1-ft. head through a ¼-in. copper pipe 6 ft. long without being heated.
5. The calorific value shall not be less than 18,000 B.TH.U. per lb.

Many other liquid fuels may be used, such as residue shale oil, gasworks tar oil, or creosote oil. There seems every probability that the market for oil is now fairly settled.

There is but little difference in fuel consumption per B.H.P.-hour between large and small Diesel engines, nor does the fuel consumption increase largely per unit of energy as the load is decreased on the engine. It is well known that a large steam engine running at light load is grossly inefficient, the fuel required to maintain steam pressure in the boilers and to run the engine light, together with the necessary auxiliaries, being out of all proportion to the work done ; also, a small steam engine requires many more pounds of steam per H.P. to run it fully loaded than does a large one. Stand-by losses, which are very great with steam plants, are absolutely non-existent where the Diesel engine is used.

The following figures, for which the author vouches personally, show the cost of fuel in pence, per unit generated, with oil at the prices mentioned, and at various loads, for a 50-B.H.P. engine coupled to a 33-KW. generator :—

Load.	Dynamo efficiency.	Price of fuel per ton. 40s.	50s.	60s.	70s.
Full	88 %	0·161	0·201	0·242	0·281
Three-quarter	86 %	0·178	0·210	0·252	0·295
Half	83 %	0·208	0·261	0·314	0·365
Quarter ...	78 %	0·307	0·384	0·462	0·538

On larger plants the costs would be some 10 to 20 per cent. better, depending upon the size of the plant.

Steam plant, if not properly maintained, becomes more and more uneconomical as time goes on ; still, the plant continues to run as though all were in order, but with an increased fuel consumption ; on the other hand, internal combustion engines—and particularly the Diesel engine—must be maintained in thorough good order, otherwise there will be great difficulty in getting them to run at all ; therefore, those in charge of such plants are bound to see that they are carefully attended to. This characteristic of the Diesel engine is a valuable one. In small steam-driven stations it requires constant supervision and a certain amount of labour to keep a strictly accurate record of the fuel consumption day by day. With a properly arranged station where Diesel engines are employed the fuel consumption may be ascertained with absolute accuracy hourly if desired, and thus it may be said that the plant is always under test.

The capital cost of a Diesel engine direct-coupled to a generator is considerably greater than a gas or steam-driven generator of similar capacity, but when the cost of complete plants, comprising either gas or steam, are compared, there is but little difference in the price per kilowatt. A Diesel station, however, requires less land and buildings than similar stations employing steam or gas plant, so that the difference, if any, is in favour of the Diesel plant.

The following are approximate prices for small plants, delivered and erected on purchaser's foundations complete with oil storage tanks, piping, &c., and may be taken as fairly representative :—

Size in kw.	*Price.*	*Price per kw.*
100	£1,950	£19·5
150	2,600	17·3
200	3,260	16·3
300	4,380	14·6
400	5,300	13·3

The author is of opinion that the life of the Diesel engine should be as long as that of a well-built steam engine. The only expensive part likely to require replacement is the cylinder liner. It is essential that the compression should be maintained. The author has had an engine running for over two years, and no appreciable wear of either the liner or piston rings has yet occurred. It appears, therefore, that the life of the liner may be computed at at least 10 years. The valves are fitted into removable casings, which can be renewed at quite a small cost.

As most of the other parts are quite light, cheap, and easy to replace, it appears that the cost of maintenance of this type of engine must be very much less than a complete steam plant.

Although the Diesel engine possesses considerable advantages, it is undoubtedly true that in order to secure reliability first-class attention is necessary. It may safely be said that 90 per cent. of the trouble experienced in running is due to the neglect of attendants. As the running and maintenance of internal-combustion engines is essentially different to that of steam plant, it is always better to secure the services of men who are accustomed to similar plant than to employ men who have spent their lives among steam plant. In spite of statements to the contrary Diesel engines require considerable supervision, and it is advisable to employ men of skill and experience rather than mere labourers. Even taking this matter into consideration, the cost of labour on moderate-sized plants is substantially less than that necessary with steam plant.

It is of importance that a suitable grade of lubricating oil should be chosen ; the oil must be a pure mineral one with a high flash-point. The author is using ordinary crank-chamber oil, costing 1s. 5d. per gallon, with perfectly satisfactory results. The cost of lubrication is about 50 per cent. greater than that of a steam engine.

The use of an excessive quantity of oil should be avoided. Oil after collection from the crank pit contains a certain amount of carbon, and should be placed in a settling tank, preferably heated. After a sufficient time has elapsed for settling, the oil should be drawn off from the top and passed through a good filter before use. The author has found that it is practically impossible to remove the whole of the carbon from the oil, and consequently if the oil is used repeatedly, more and more carbon will be fed into the cylinders and other parts until there is a sufficient accumulation of carbon to cause a stoppage of the lubricating passages. As a seizure of the piston might cause serious damage to the engine, and as it is necessary to economise in lubricating oil as much as possible by using filtered oil, the author recommends that the piston should be drawn every six months, and the lubricating passages cleaned.

The carbonisation of oil may also cause trouble in the air-compressor cylinders. Before the author realised this possibility, filtered oil was always used in the compressor, and probably to excess. In course of time the high-pressure air-pipe leading from the compressor to the intercooler blew off at the joint, when it was discovered that the pipe was completely blocked with solid carbon.

Owing to the high compression, which must be maintained, it is necessary to keep the valves quite tight. The author has found that under the conditions in which he is working, the valves will run without any attention for the following periods :—Exhaust, 600 hours ; air, 2,000 hours ; fuel, 600 hours ; starting, one year.

The needle or fuel valve is so adjusted that the fuel spray is blown into the cylinder two or three degrees before the crank reaches the top centre on the compression stroke. It is very important that this valve should be properly set and quite tight ; if there is any leakage fuel will be admitted at the wrong time, resulting in irregular running of the engine.

The pulveriser is liable to become choked if the fuel is dirty and insufficiently filtered ; it should, therefore, be examined and cleaned at the same time as the needle valve.

A considerable quantity of vapour is carried into the compressor, the quantity depending upon the humidity of the atmosphere, and is condensed in the intercooler ; it causes rusting of the interior surfaces, and the rust is carried along to the starting valve where it will accumulate, eventually causing the starting valve to stick. If this occurs, the contents of the bottle may be lost before the valve can be shut. The only precaution necessary to avoid this annoying experience is to see that the intercooler drain is blown down at regular intervals, say, every half-hour, particularly in damp weather. The air-storage receivers are provided with siphons and drains, and should be drained every day.

It is well to draw the compressor pistons every six months and clean off the accumulation of carbonised oil which is deposited on the top. It is also advisable to clean the air inlet and passages to the low-pressure valves at the same time.

Where only one engine is installed in an isolated position, the loss of the air in the storage cylinders would be a serious contingency, as without such a supply it would be a difficult matter to start the engine. If the engine is driving a dynamo, and there is a storage battery on the premises, the dynamo may be run as a motor to drive the engine and compressor. Alternatively the storage bottles may be charged from cylinders of oxygen or carbonic acid gas. If the latter is used, the cylinders and pipes should be warmed in order to prevent solidification of the gas in the pipes. If the engine is erected in a locality where it is unlikely that either of the above facilities will be available, it is desirable that a small independent compressor, coupled to an ordinary oil engine, should be put down as a safeguard.

Defective starting is generally due to low compression, defect in oil pump or oil supply, or incorrect adjustment of fuel, air or exhaust valves.

Black smoke may be emitted if the blast pressure is too low, or if the engine is overloaded. If all is in order the exhaust should be colourless, indicating perfect combustion of the fuel. The exhaust gases escape from the engine at a pressure of about 40 lb. per sq. in., and adequate measures should be taken to allow the escaping gases to expand gradually, or nuisance may be caused to the surrounding neighbourhood. The author had some trouble, due to the fact that private residences are in close proximity to the works. The exhaust, therefore, was led to a large concrete pit, which removed all cause for complaint. It is the intention of the author to lead the exhaust from a 150-B.H.P. engine, shortly to be installed, to the base of an existing chimney stack 120 ft. high, which should deal with the difficulty in an effectual manner.

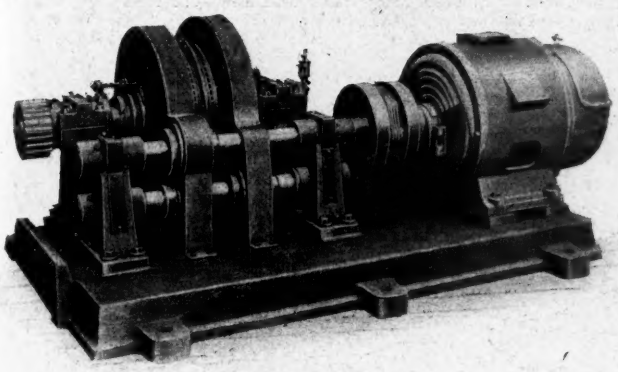


Fig. 1.—Vulkan Reversing Drive for Planing Machines, &c.

dameter, and has a 3-in. pitch double thread, running at 126½ R.P.M. The planer will work on a stroke of 5½ in., if necessary.

On test, driven by a 220-volt D.C. motor, the motor and clutch gearing only running, took 7 amperes, and when the clutch was excited so that the main screw and saddle were running light, the current was 15 amperes, with a maximum kick on reverse of 36 amperes, which included 1·7 amperes taken by the clutch.

As regards the striking gear, the saddle is fitted with a finger which strikes the dogs, which are carried on a rod running the length of the machine, and operates the automatic reversing switch. A switch is also fixed on each housing to stop the clutch, if necessary. The clutches are supplied in this country by Messrs. C. E. Lugard and Co., of St. John's House, Chester.

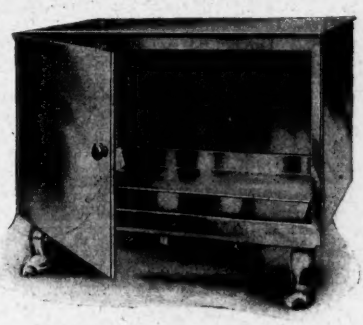


Fig. 2.—Simplex Oven on Hot-plate.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Magnetic Clutches on Plate Edge Planers.

We illustrate in fig. 3 some plate-edge planers, equipped with the Vulkan drive, which have just been delivered to an Austrian dockyard.

Each machine measures 38 ft. 3 in. between the housings, and is capable of planing a plate 33 ft. long, 1⅜ in. thick, at 40 ft. per minute.

A cut of ·07 sq. in. can be taken in steel of 41-ton tensile strength, or at the rate of 9·4 lb. of metal removed per minute.

The tool turns over automatically on reversal, the turnover being done while the saddle travels 4 in. It can also be dropped so as to scalf a plate up to 15°.

The motor, fig. 1, is of 30 B.H.P., three-phase, 42 cycles, running at 1,200 R.P.M. in one direction only, the reversals being obtained by a Vulkan electro-magnetic clutch through the ordinary five-wheel change spur gearing.

The clutch shaft runs at 330 R.P.M., and is connected to the main screw through a steel pinion of 23 teeth and a spur wheel of 60 teeth (1-in. pitch). The main screw is 5 in.

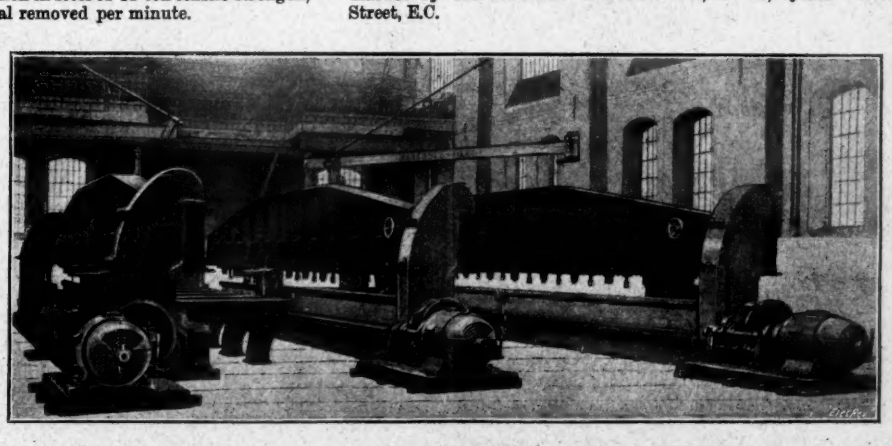


Fig. 3.—Plate-Edge Planers, with Vulkan Electric Drive.

Simplex Combination Cooking Outfit.

The "Combination Cooking Outfit" made by Messrs. Simplex Conduits, Ltd., in its preliminary form has already been described in our pages; it has proved so successful in actual practice under working conditions, that improvements in the design in several directions have been made, and at the same time its sphere of usefulness has been considerably extended. It is now capable of carrying out all the necessary cooking operations for a small household, and in large establishments it is a most useful adjunct to the main cooking installation. It provides a ready means of testing electric cooking and the cost, even if the apparatus be purchased outright, is extremely small, and well within the reach of the great majority of consumers.

Two larger size plates have now been produced of 8 in. and 10 in. diameter, with loadings of 800 and 1,000 watts each respectively. These hot plates are intended for use with correspondingly larger ovens. In the case of the small set the oven is capable of cooking chops, steaks, a bird, or a small joint, say of 3 lb. weight. The largest pattern will take a 9 or 10 lb. joint.

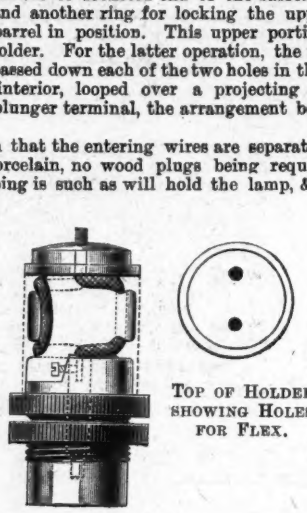
The oven is made of polished metal, to prevent radiation of heat, and has an aperture in the bottom, which fits on the hot plate, as shown in the accompanying illustration. The 8-in. and 10-in. boiling plates are arranged for temperature regulation by means of the standard three-pin terminals, giving four variations of temperature. A more convenient method is supplied at a small extra cost, and incorporates the use of a special heat regulation switch. This is suitably attached to the boiling plate, and is arranged with an indicator showing the exact heat—one-third, two-thirds, or full—which is being used. The clear indication of the condition of the heat regulation assists economy in current consumption in actual practice. The makers will supply descriptive leaflets to applicants, for distribution, gratis.

The "Ezyfix" Two-Part Lampholder.

Another ingenious patent lampholder which has recently been brought to our notice, is the "Ezyfix," which is being placed on the market by the Eastern Electric Co., of 11, Queen Victoria Street, E.C.

For all practical purposes this is a two-part lampholder; that is to say the porcelain interior is in one piece, and is permanently attached to the lower or socketed end of the barrel, which carries the shade ring and another ring for locking the upper detachable portion of the barrel in position. This upper portion is removed for wiring the holder. For the latter operation, the flex is divided, one wire being passed down each of the two holes in the upper end of the porcelain interior, looped over a projecting side lug, and inserted in the plunger terminal, the arrangement being shown in fig. 4.

It will be seen that the entering wires are separated throughout their run by porcelain, no wood plugs being required; the grip obtained by looping is such as will hold the lamp, &c., even if the



Top of Holder showing Holes for Flex.

Fig. 4.—"Ezyfix" Lampholder, showing Wiring Arrangement.

wires are withdrawn from the plunger terminals. The permanent attachment of the socketed end of the barrel to the interior, obviates the possibility of the lamp falling off owing to the slacking-off of a loose locking ring.

The arrangement is extremely ingenious, and appears not only fully to meet the claims of the inventors, but also to be a substantial move in the right direction, namely, that of simplicity.

Composite Telegraph Poles.

In our "Correspondence" columns, Mr. P. J. Pringle draws attention to a type of pole which has been in use in Australia for some 10 years past, but which apparently has not hitherto been adopted in this country. The idea is to avoid the decay which inevitably occurs at the ground-line of wooden poles set in the

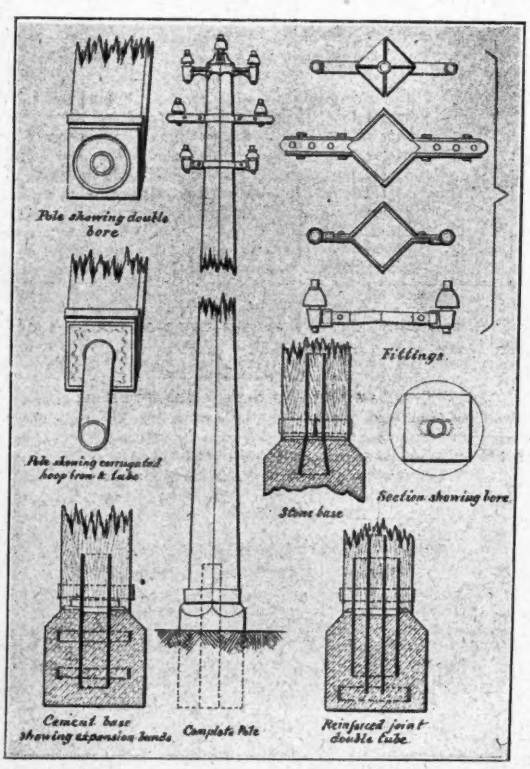


Fig. 5.—Details of Commons's Patent Composite Pole.

ground, and to improve the appearance of the pole, which consists of a straight timber shaft joined to a concrete base. The joint is effected by means of a steel tube, one end of which is inserted into the butt of the pole, and firmly cemented in place with bitumen, while the projecting part of the tube is shod with concrete, as shown in the illustration, fig. 5. An iron band shrunk on the end of the wood prevents the pole from splitting. The strength of this simple joint is surprising. According to some tests made at the Melbourne University, a pull of 7½ tons was required to draw a 2¾-in. tube out of the end of an Oregon pole 4½ in. square, and the strength of the joint against bending is 70 to 80 per cent. of that of continuous timber of the same cross section. Moreover, the failure of the joint, when it occurs, is gradual—bending, not fracture.

The pole being squared, iron fittings are used which fit any standard pole, and they are applied in the direction of the diagonal, so as to utilise the greatest resistance to bending either along or across the line of wires. The complete pole weighs less than an equivalent ordinary hard-wood pole, but slightly more than an iron pole. The manufacturers are the Tubular Joint Composite Telegraph Pole Co. of Australia, Ltd., Ballarat, Victoria.

Drum-Type Starters for Induction Motors.

The Electrical Apparatus Co., Ltd., of South Lambeth Road, S.E., has recently developed a line of drum-type switches for starting squirrel cage motors; these are arranged to give star-delta connections for three-phase motors and series-parallel for two-phase motors, or they can be arranged to switch the motors

Fig. 6.—E.A.C. Starter for Squirrel-Cage Motors.

direct on the mains, cutting the fuses out of circuit in the starting position.

Among the points emphasised by the makers are the use of coil compression springs of tested strength, easy of adjustment; substantial copper finger tips, self-aligning contacts, renewable wearing parts, &c.

As the motor is disconnected from the line with the switch in the "off" position, no main switch is required; the "full on" position cannot be reached without a pause in the starting position, but the handle will not remain in the latter position when released.

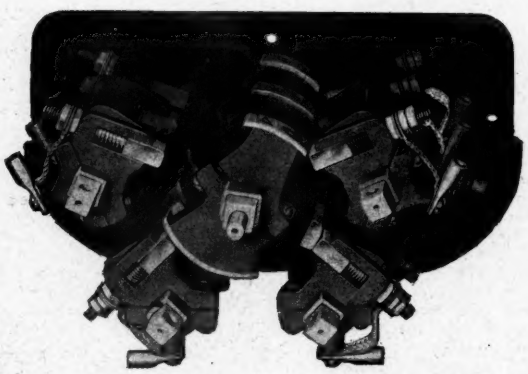


Fig. 7.—Interior Mechanism, E.A.C. Starter.

The totally-enclosed type (shown in fig. 6) is recommended for textile mills, &c., while an oil-immersed type is suitable for mining work and can be made flame proof. Various automatic features and the E.A.C. interlock can be fitted.

The switches are designed for up to 200 amperes and 3,500 volts; our second figure shows the interior mechanism—contact fingers, coil compression springs and drums.

Cascade Motors.—Messrs. Siemens-Schuckertwerke, of Berlin, have taken a licence for the manufacture of "Sandycroft-Hunt" cascade motors in Germany.

LEGAL.

OSRAM LAMP WORKS, LTD., *v.* THE "Z" ELECTRIC LAMP MANUFACTURING CO., LTD.

(*Concluded from page* 833.)

MR. H. BALLANTYNE was then cross-examined by MR. ASTBURY: On the patent of 1904 it is perfectly plain, is it not, that what he means there is that if you take a carbon core and merely coat it with metal and then run it, that metal coating will not suffice to prevent that carbon core doing what all carbon-filaments would do if they were run at a sufficient temperature and for a sufficient time, viz., disintegrate?— Yes, but I think it is a little more than that, because a tungsten-coated carbon-filament would be intended to run at a higher temperature than ordinary carbon, so that the tendency for this carbon to volatilise would be still greater.

Whether that disintegration is the mere effect of temperature, or whether it is the combined effect of temperature plus electrical current, you cannot say?—No.

You have said that if you take one of these tungsten filaments and run it up near to the melting point of tungsten, your view is that the carbon comes out non-chemically?—Yes.

Are you going to pledge yourself as a chemist that because carbon somehow or other comes out of a filament in a non-oxidising atmosphere at a certain temperature, if you have a totally different atmosphere which is chemically known to take it out in another way, it takes one course rather than the other?—That is my clear opinion. You have to have regard to the conditions under which this chemical atmosphere is operating or under which it is capable of operating. In my opinion, as a chemist, I do not consider that that chemical action can come into play in the time to any substantial extent.

The reason of that is that you think there is this little filament in a big atmosphere. You think the atmosphere cannot get to the filament?—Yes. If I am correct in the view that the carbon is eliminated physically and not chemically, then it is quite immaterial what the nature of the circumambient gas is; it will come out in exactly the same way.

You have expressed an opinion that this patent points to a direction or an intention to use soft paste?—Yes.

HIS LORDSHIP: And to use a paste which is not used by the defendants?—Certainly.

You have already told me that in your view a soft paste does not necessitate squirting into a liquid at all?—I say that if you take a soft-paste filament, you must coagulate that filament.

Have you ever made any experiments to ascertain how much of the carbon contents of the defendants' baked filaments are in the form of carbon and how much are in the form of carbide?—No.

Do you disagree with what I am told, that the instant effect of putting the current through the filament is to make a tremendously strong convection of the gas towards and through the length of the filament?—That is one of the results which, in my opinion, is far outweighed by the fact that you have the sudden expansion away from the filament.

You made soft filaments and sintered them, and found them quite good?—Yes, they sintered quite well.

With regard to the Lodyguine filament which you say you had made. You made one with a platinum fillet, and ran it for five minutes at a lower temperature—lower than sintering?—Yes.

When you took it to the blinding white heat it broke?—After 30 seconds it broke at the clip.

And when you examined it you found it was in tubular form and the platinum had come out?—Yes.

MR. ASTBURY then took witness through other experiments which had been made, with a view to showing how witness got rid of the carbon out of the filaments.

At the conclusion of a very short re-examination by Mr. Terrell, Mr. Astbury said to his Lordship: I am really in a difficulty here. I do not make any complaint, but I must tell you honestly I think the case which has been made, and is weighing on your Lordship, has not been put to our witnesses at all. I have been through, as well as I could, every line of cross-examination of our witnesses, and I have made a list of the matters that have been put in evidence-in-chief which I am absolutely satisfied have not been put to my witnesses. Counsel then referred to many passages in evidence given in support of his contention.

HIS LORDSHIP said the important point seemed to him to be whether or not to use a hard paste—that was to say, to use such a paste that one must use tons of weight to put it through a diamond die to make the finer filaments—was or was not the best process. If the patentee had discovered that that was the best process, then he ought to have said so.

MR. ASTBURY then went through the list of points which he said had been raised by Mr. Terrell since the case was opened.

HIS LORDSHIP said the further evidence he would allow Mr. Astbury to call must be confined to the points which had been mentioned.

Evidence was thereupon called by MR. ASTBURY on the points in question.

DR. OTTO OBERLANDER said he had been a consulting chemist in England since 1906. Prior to that he was assistant to Prof. Noelting in Germany, and also a works chemist in that country.

How did you first come into contact with this patent Just and Hanaman of 1904, which is being sued upon in this action?—I met the manager of the General Electric Co., Ltd., who told me that it was essential for his concern to have a metal-filament lamp, and asked me whether I could take this matter up. That was about September, 1906.

At that time had the General Electric Co. who were instructing you an interest in the patent at all?—No.

When you came to it in its turn what did you do?—I repeated the process and I made filaments.

In making filaments under it what paste did you use?—The first was a fairly tough paste of tungsten metal and gum arabic.

Why did you use a stiff paste?—I wanted to squirt it through fine orifices, and I gave it such a consistency as would give a good thread.

Did you squirt your own stuff into a liquid or not?—No, I squirted it in air simply on a card and collected the thread as soon as it was made.

When WITNESS had got these threads squirted and made, they were carbonised in a current of hydrogen in a combustion furnace. They were then mounted in clips and decarbonised in steam and hydrogen.

What did you understand the patent to mean by steam and hydrogen?—It meant to have so much water vapour as will remove the carbon, and to have so much hydrogen as will protect the tungsten.

WITNESS passed hydrogen through water, and it was, therefore, charged with something like 2 per cent. of water vapour. He passed the current through the filament and saw almost instantly a sintering operation taking place. The filaments were raised to a good red heat. The sintering took from a minute to two minutes, or less.

In those early days did you know of any pointed distinction between decarbonising and sintering as such?—No.

The filaments were mounted in bulbs by the men who were accustomed to do that particular work. All the filaments appeared uniform to such a degree that he did not consider it necessary to render them uniform. When these filaments were mounted in lamps they were satisfactory. He had made filaments, and what was called stiff paste of many varying degrees of stiffness, and had never found any difficulty in making any of the filaments so obtained into lamps.

It has been suggested by the other side in this case that if you make a soft paste, or if you do not make this excessively hard paste of the defendants, the uniformity or flashing process is a necessity?—That is not my experience.

In some of the softest pastes which you have used, whether you squirt into air or whether you squirt into liquid, have you found that they do or do not require to be rendered uniform by this subsequent process?—In my opinion, they do not require to be rendered uniform, except a very few of the filaments. When you make a filament, the fact whether or not it shows any bright spots indicates whether or not it is necessary to render it uniform, and in such cases I did render them uniform.

As a result of your early experiments and what you did under this 1904 patent, I think Mr. Hirst bought the patent?—Yes, I advised him to, as I did not know of any anticipation or any other reason why the patent should not be good.

Are you familiar with the way in which the weights have always been used in the Osram lamp works?—Yes.

There were two alleged disadvantages mentioned by Mr. Pakenham. First, it is suggested that, if you put the weight on during sintering, you get a cooling or some other action of that character at the apex and an insufficient sintering, and, at all events, a weakening there?—It is not my experience, neither is it the experience of the people at the works.

I think the Osram Co. make something like 5½ millions a year, do they not?—Yes, I am told so.

That is to say 5½ million lamps, and the lamps I think contain about 10 filaments each?—Yes.

So that it would be about 50 million filaments a year?—Some of the filaments break in manufacture, therefore it would be nearer 75 millions.

If this weighting during sintering had any such disadvantage as is alleged, is it possible that you could not have found it out, or heard of it?—I do not think so.

HIS LORDSHIP: All your filaments are made in this way, are they?—Every one, of all kinds, and of all types and thicknesses.

Going back to 1904, from your knowledge of the literature, what, in fact, was carbonising of a filament, and what did it mean?—Carbonising in 1904 or 1912 does not mean anything else but destructive distillation of the hydrocarbon.

Does the reduction of the pressure at which the defendants bake their filaments in any way prevent them obtaining the necessary result of carbonisation?—No.

Taking the defendants' paste and baking filaments made of it in carefully dried hydrogen at ordinary pressure, do you get any difference in result between the filaments so baked and the filaments baked by them?—No, the result I got is ·776 per cent. of carbon at atmospheric pressure in carefully dried hydrogen free from oxygen.

In Welsbach's Specification 1,535 of 1898, he says:—"The function of the protective atmosphere is to oxidise the carbon of the filaments without oxidising the osmium or obtaining a deposit of carbon on the filament. Free oxygen must not be present, and, in fact, the atmosphere should be such as will reduce any oxides of osmium that may be present. In such a reducing atmosphere the filament can without danger be raised to a temperature which consolidates the osmium and forms it into a useful coherent filament." Is there, in your opinion, any difference between that and sintering the metal which forms it into a coherent metal filament?—None.

It is suggested that our patent intended you to decarbonise, and not to sinter?—Yes.

Supposing you knew nothing about this discussion, and that you simply took your baked filament and put it in an atmosphere of steam and hydrogen, as the patentee tells you, and subjected it to the passage of a current; if you do absolutely nothing else, will

nature itself gradually get more and more current going through it until you get to constancy?—Yes. I do not know of any way to prevent it.

If it goes on in that way until it gets to constancy, is it physically possible to stop the sintering?—No.

There is another suggestion, that if you have enough water-vapour to oxidise the carbon, you cannot help oxidising the tungsten if the temperature goes up to that at which the metal will sinter?—That is not my experience.

Dr. Adolf Liebmann was also recalled and examined on similar points, at the conclusion of which Counsel addressed the Court on behalf of their respective clients.

In reply to his Lordship with regard to the counterclaim, Mr. Terrell said that, after consideration, he had decided to withdraw it.

Judgment.

Mr. Justice Warrington, in giving judgment, said this was an action for infringement of three patents, all relating to the manufacture of metallic filaments for incandescent electric lamps. The first was a patent for the manufacture of such filaments from the metal tungsten. The second related to a particular mode of effecting one of the steps in the process of manufacture. The third was for a small practical detail in producing a metal filament of the now common shape of a more or less pointed loop. The date of the first patent was November 4th, 1904, that of the second August 20th, 1906, and that of the third August 30th, 1906, being the date of the first foreign application. In the case of all three patents the defendants attack their validity, and in the case of the first two they deny infringement. As to the third, they admitted that they had infringed, but said that they were not now infringing, and did not intend to do so in future. The general subject-matter of the inventions, or alleged inventions, was the manufacture of metallic filaments suitable for use as the incandescent bodies in electric lamps of the incandescent type. The particular kind of metallic filament with which they were concerned was that which was manufactured by a process often referred to in the course of the case as a building-up process. His Lordship then went through in great detail the building-up process, as well as the specification in question, which had been amended, and which, of course, had to be considered in its amended form. The first question was, what was the true construction of the specification. What was it the patentees described and claimed? They mentioned the application of tungsten as a coating material for carbon and plainly did not claim that; they expressly disclaimed their own oxychloride process—Kellner's proposal to form the filaments by pressing and the drawn-wire process of Siemens. Bearing that in mind there was no difficulty of construction. The first claim was limited to a tungsten filament made in the way described. The second claim was for the process for the manufacture of the bodies mentioned in the first claim, the process being characterised by the special feature particularly referred to. He thought the words: "In accordance with Claim 1" were a qualification of the word "bodies" and meant in substance, "such bodies as accord with the description given in Claim 1." It was, he thought, the essence of the claim, the second claim, that the carbon should be removed chemically. The principal objection to the validity of this patent was want of subject matter. In the general description of the process itself there was nothing new. It was merely the building-up process already referred to. The first paragraph on page 3 described the process of mixing and the carbonising process long used for making carbon filaments. The second paragraph described, first, the decarbonisation by oxidation already described by Welsbach, and, secondly, a process of rendering the filament uniform by means admittedly already employed in connection with carbon filaments. The invention, if there was any, consisted first in the application of the known process to the particular metal tungsten, and, secondly, in the selection of the atmosphere of steam and hydrogen as a suitable atmosphere for the purpose of oxidising out the carbon from a substance consisting of tungsten and carbon. It was said that the relevant qualities of tungsten were so well known that any person acquainted with the subject, if reminded of the existence of tungsten, would know at once that this metal would be suitable for the purpose. He thought it was impossible to reconcile that view with the facts. In the first place, he was satisfied that though it was known that tungsten was highly refractory, and that it was reducible from the oxide by the action of hydrogen, it was impossible to say without actual experiment whether a filament could be made of it in the mode described. In fact, the patentees' process of decarbonising in steam and hydrogen was actually tried by Dr. Liebmann upon a number of the highly refractory metals, including uranium, which was in the same group with tungsten, without success. It seemed to him (his Lordship), further, on the evidence, that the selection by the patentees of steam and hydrogen as the atmosphere in which decarbonisation was to be effected, also required experiment. But there were other considerations which, in his opinion, led inevitably to the same conclusion. Tungsten was a very common and cheap metal. Osmium and the other metals mentioned by Welsbach were scarce and dear. Tungsten had now practically superseded all other metals in the manufacture of filaments. It was recognised as a suitable metal to employ for electric lighting, as shown by the various suggestions for its use, to which reference had already been made. He could not believe that if its suitability for the purpose of making a filament by the process described in the specification had been so obvious as was pretended, its use would not have been suggested by Welsbach or one of the other inventors who were searching for a practicable mode of making a metal filament. He found that there was sufficient invention to support a patent, and that the objections on the ground of want of subject matter failed. A further objection which he had one time thought might be of importance, was that of insufficiency of description. The point was that no details were given as to the proportions of metal to binding material, of steam to hydrogen, and the temperature, and so forth. In his opinion, the furnishing of such details was in the particular case unnecessary, for that a lampmaker of ordinary skill and knowledge reading the specification would have had no difficulty in putting it into operation. The first paragraph on page 3 obviously required no detailed description, as it was the ordinary process of making a carbon filament applied to one of carbon and tungsten. The decarbonising process required no further description, for he found on the evidence, and in particular on that of Dr. Oberlander, that anyone having a reasonable knowledge of the subject would be able without difficulty to decide on the proper proportions of steam and hydrogen—the appropriate degree of temperature was indicated by the direction to raise the filaments to a high temperature by subjecting them to the passage of current. In his opinion that objection also failed. No other objection to validity had been pressed, and he must, therefore, hold that the patent was valid. Then there remained the question as to whether defendants had infringed the patent. First, what had been rejected? They did not make use of the process of rendering the filament uniform described in the specification, not finding it necessary to resort to that process. It was said that this was an essential part of the plaintiffs' process, and that as it was not taken, the patent was not infringed, even if the defendants did the other things described. It was settled by law, and what was the real substance of the invention, whether it be a combination or a process must be decided on the evidence—in other words, it was a question of fact. He found, as to that, that the process in question was not an essential part of the invention; good filaments could be made in the manner described, and the substance of the invention taken, though that step was omitted. He had now to consider whether the substance of the invention had, in fact, been taken.

The process adopted by the defendants was then read by his Lordship, who said that he found that the atmosphere used was an atmosphere of steam and hydrogen within the meaning of the specification in question. It was said that the claim was limited to the removal of the carbon chemically, and that the process adopted by the defendants removed it by physical or mechanical means. As to that, it was admitted that carbon monoxide was formed. That showed that there was in the process a chemical reaction resulting in the oxidation of carbon. But the defendants maintained that, bearing in mind the very short space of time and the very high temperature, the proper conclusion to draw was that the carbon was removed by volatilisation or by the mechanical effect of the current, and that the oxidation, such as there was, took place after such removal. In his opinion, that was not proved. The steps directed by the patentee were taken, the result indicated by him was obtained, there was certainly some such chemical reaction as he suggested, and it would in his (his Lordship's) opinion require much stronger evidence than any before him to justify the conclusion that the real action of the means adopted by the defendants was so different from the patentees' method as not to be infringement.

As to the first patent, he was of opinion that it was valid, and that the defendants had infringed, and the plaintiffs were entitled to the usual relief.

The second patent (18,622 of 1906) was for an improved method of producing metallic incandescence bodies for electric glow lamps. The point of this invention was to substitute in the decarbonising process gases containing no oxygen for the oxidising gases previously employed, and he thought the absence of oxygen was its essential characteristic.

The validity of this patent was seriously attacked on one ground only—that a patent for the same invention had been previously granted to the same patentees. This last patent was No. 15,510 of 1907, but protection dated from July 11th, 1906, the date of the first application in Germany, and was therefore prior to the plaintiffs' patent. This patent (15,510) was entitled again—"Improved process for the manufacture of illuminating bodies for electric incandescence lamps." The patentees begin by referring to the British specification No. 23,899 of 1904, and they refer to it in these terms. They say that in that specification is described a method of making tungsten and molybdenum filaments for incandescent lamps. It was, in fact, of course the specification of the first patent in the present case. It was referred to there as a method of making tungsten and molybdenum filaments, but molybdenum was afterwards struck out by amendment. The reference laid stress on the fact that the carbon was to be removed by oxidation. Another specification was then referred to of 1905, by which it was pointed out that the oxidising agent must bear but a small proportion to the quantity of hydrogen present, and so far as one was aware, it had heretofore always been assumed that it must be at least from 1 to 2 per cent. as set out in the prior Specification 19,379 of 1905. He was of opinion that the second claim was merely what it said, that the hydrogen was diluted with nitrogen, but that in that atmosphere so diluted there were still traces of oxidising means. In his opinion, that was not the same invention as the plaintiffs'. In the claim he had just referred to, oxygen, however small, was regarded as essential. In the plaintiffs' patent the essential feature was the absence of oxygen. The defence of prior grant failed, and he must hold the patent to be valid.

The really important defence in this case was non-infringement. From what he had already said, it would be seen that for the substantial decarbonisation of the filaments, the defendants used the oxidising process and not that which was the subject of the patent now under discussion, but the plaintiffs insisted that the

defendants used the latter in the subsequent stages of the manufacture. (Here his Lordship described the process.) In his opinion, there was here no infringement of the patent rightly understood. The patent was for a method of producing a filament from the metals mentioned in the specification. In substance it was the substitution of the process described for the process of decarbonisation by the action of oxygen-bearing gases. It did not, in his opinion, cover such a process as the final process of the defendants, which was not a method of producing a metal filament at all—that had already been in substance produced—but was merely a device for improving the filament so produced. To say that the defendants were not at liberty to adopt such a device because, incidentally, a little carbon was eliminated by the action of ammonia, would, in his opinion, give an extravagant effect to the patent. On that ground the action on the second patent failed and must be dismissed.

The third patent, 8,563 of 1907, was for an improvement in one of the mechanical details of the manufacture. The point was this—Before the date of this patent, filaments made in the mode described assumed, after the sintering process, the shape of a more or less irregular loop. To obtain a more suitable shape a small weight was hung at the bottom of the loop, and the filaments were again subjected to the action of current under somewhat similar conditions to those of sintering. It occurred to the patentee that instead of doing that as a separate step in the manufacture, the weight might be applied during the sintering process itself. The alleged invention was nothing more or less than this. It was unnecessary to read the specification. The defendants admitted that for some time they used weights during the decarbonisation and sintering, but they said they gave up the practice for reasons of their own, and were not now pursuing it and did not intend to do so. If the patent was valid they had certainly infringed. The validity of the patent was disputed on two grounds, first, on the ground want of subject matter, and, secondly, on that of prior user. As to subject matter the plaintiffs claimed, and the patentee's suggestion was a very bold one, viz., the application of a strain to a thread still containing some binding matter at a moment when that was being removed, and before the sintering or cohesive process had been completed. Plaintiffs' scientific witnesses strongly supported that view. To men of the scientific eminence of the plaintiffs' witnesses who realised what was actually occurring to the structure of the filament, the difficulty of applying a weight at the moment in question might well appear to be a serious one, whereas the practical man of ordinary but sufficient knowledge being aware as was the case, that a slight strain of the nature of that in question had been used in the making of carbon filaments, might without further thought apply such strain during the decarbonisation and sintering. So far as the result was concerned, the filaments made in the two ways seemed to him to be substantially identical in form. Plaintiffs' plan no doubt avoided a second operation, and he thought that fewer filaments were spoilt in the sintering, as they were kept steadier by the weights. For all that he thought the change so unimportant and the amount of invention required to effect it was so minute that he must hold the patent to be invalid for want of subject matter. He need not consider with any minuteness the alleged prior user. He had, however, come to the conclusion that the objection ought to fail for the reason that the alleged user was experimental only, and not a user of the invention within the authorities.

So far as regarded the first patent, then plaintiffs were entitled to an injunction and to damages, or an account of profits and the other usual relief. As regarded the second and third patents, there must be judgment for the defendants. The action was really three separate patent actions in one, and the costs, therefore, must be apportioned. So far as they related to the first patent, they must be paid by the defendants, but so far as they related to the second and third, by the plaintiffs, and there must be a set off.

Mr. Walter: As regards the first patent, I ask your Lordship for a certificate of validity, and we will take an inquiry as to damages, reserving the costs.

His Lordship: Very well.

Mr. Terrell: With regard to the first patent, I am going to ask for a stay of the injunction, because this is stopping a great industry. We will proceed with the appeal as fast as we can.

Mr. Walter said that might be reasonable on certain terms.

After some discussion, his Lordship said I do not think I ought as a term of staying the injunction to require any security whatever. The defendants undertake to pay into Court a certain proportion of the moneys which they will realise by the sale of the lamps during suspension of the injunction, and I think if the undertaking is given in this form it ought to be sufficient.—An undertaking without prejudice to the inquiry as to damages, to pay into Court by monthly payments, on the 21st of each month, 1d. per lamp manufactured during the past month, and an undertaking forthwith to give notice of appeal, and to prosecute the appeal diligently, and then stay the injunction pending the appeal.

Counsel assented, Mr. Walter intimating that there would be a cross appeal.

Pilkington *v.* Edinburgh School Board.

A settlement has been intimated to Lord Dewar, in the Court of Session, in the action by Basil A. Pilkington, electrical engineer, 13, Melville Place, Edinburgh, against Edinburgh School Board, for payment of £73, the amount found to be due to pursuer by an arbiter after a reference on questions between the parties in regard to work which the pursuer had done for the defenders at Tower Bank School, Portobello. The School Board maintained that they were due the pursuer only £19. They paid him for items in his account not in dispute £321. To this they added £73 allowed by the arbiter, a total of £394. They had already paid the pursuer £375, leaving the balance of £19, which they admitted was due. Intimation was made that the pursuer was not to proceed further with the case, and Lord Dewar accordingly granted absolvitor, with expenses.

IN DARKEST AFRICA.

We are indebted to an esteemed correspondent for the opportunity of whiling away our Whitsuntide holidays by the perusal of a collection of documents, as to the contents of which we now propose to enlighten our readers.

It will probably be remembered that as far back as March, 1907, the Corporation of Johannesburg was placed in a serious position owing to the failure of the gas engines which had been laid down, and it became necessary to install a steam plant. Two 500-kw. sets were put in, and in July of the same year a 1,000-kw. set was erected. In January, 1908, two further sets of 1,000-kw. and 500-kw. respectively, were called for, and again in July, 1908, yet another 1,000-kw. set. All these were reciprocating plants, and before proceeding further, we will look into the question of what these plants were and the circumstances attending their purchase.

The first two sets were ordered from Messrs. Reunert and Lenz, the General Manager of the Tramways Department being assisted in the consideration of the tenders by an advisory committee of four consulting engineers. This committee consisted of Mr. A. M. Robeson, consulting mechanical engineer to Messrs. H. Eckstein & Co.; Mr. H. C. Behr, who acts in that capacity for the Consolidated Goldfields of South Africa, Ltd.; Mr. D. Gilmour, who occupies a similar position with the Johannesburg Consolidated Investment Co.; and Mr. A. C. Holtby, of Messrs. Neumann & Co., who was afterwards added to the Committee.

As very quick delivery was required, the order was secured, as stated above, by Messrs. Reunert & Lenz, although their price—over £10,000—was some £2,000 in excess of the ordinary market price for such machines.

The second case, when in July, 1908, a 1,000-kw. set was asked for, shows the beginning of differences of opinion. The municipality invited tenders for either a turbine or a reciprocating engine. The general manager recommended two Allen-Siemens sets of 500 kw. each, but the Advisory Committee, constituted as above, unanimously recommended the installation of a 1,000-kw. Parsons turbo-generator. The Council, with a lofty disregard of the advice of the technical experts, placed the order with Messrs. Reunert and Lenz for a 1,000-kw. Belliss plant. The tender accepted by the Council was £12,387 without condensing plant; that for the Parsons plant was under £6,000.

The third contract, for one 1,000-kw. and one 500-kw., was again placed with Messrs. Reunert & Lenz. Alternators were involved on this occasion, and the price was, again, some thousands of pounds greater than the prices asked for turbine-driven sets.

In the fourth case, the final tenders left for consideration were a 1,000-kw. Belliss-A.E.G. plant and a Parsons plant of 1,800 kw. then running at the Franco-British Exhibition. The prices were £12,683 for the first, and for the second—nearly double the size—£10,470. The general manager and the Electric Light and Tramways Committee, recommended, as one would expect, the Parsons tender, and the Advisory Committee's recommendation on the same lines, mentioned above, still held good. Moreover, in this case, the Corporation's consulting engineers in London inspected and tested the actual plant, and, of course, the plant being at work already, no question of delivery could arise. After protracted discussion, the Council gave the tender to Messrs. Reunert & Lenz for the Belliss plant. The Labour members of the Council voted for the Committee's recommendation.

We are not surprised that, on the publication of the facts, strong comments were made on the tactics employed to get the recommendations defeated.

Thus we see four contracts given away to one firm, at prices far in excess of what need have been paid, and in face

of the best engineering advice procurable, which advice was not offered in an officious manner, but was solicited, and, we presume, paid for, by the Council.

This much is written in order to prepare our readers for what follows. The feeling of surprise at the Corporation's methods will, we think, give way to feelings of dismay.

Last year the municipality asked for a third turbine, two having been laid down already by Messrs. Reunert & Lenz, manufactured by Messrs. Belliss & Morcom.

Tenders were received from practically all the British and foreign manufacturers, and the engineer, Prof. Dobson, reported that Messrs. Reunert & Lenz should be awarded the contract for another Belliss turbine. When the report was published in the Press, it was found that the tenders were not reported upon in their original form, but after the figures had been so manœuvred that Messrs. Reunert and Lenz's tender, though high in price, became equal to the lowest tender.

All the other tenderers seem, then, to have held an indignation meeting, and the Johannesburg Chamber of Commerce decided to protest officially against the treatment that the unsuccessful tenderers had received. They wrote to the Corporation, who requested that the Chamber would send a deputation to meet the Council. This was done, but with no result, and finally the Council, after further representations and protests, and in view of the strong opposition now manifested as to the way in which the tenders had been handled, agreed to call in two experts to report on Prof. Dobson's recommendation, and to advise the Council which tender to accept.

On March 27th a letter was written by the town clerk of Johannesburg, from which the following is a quotation :—

"1. To report to the Council as to which is the most advantageous tender for the Council to accept, bearing in mind the present condition of affairs at the power station.

"2. To report further on Prof. Dobson's three reports referred to in the criticisms made by the members of the electrical section of the Chamber of Commerce, and on those criticisms as contained in the two memoranda dated May 13th and March 15th, 1912, respectively, and on Prof. Dobson's reply to those criticisms, and (3) to report generally on any matters at the Council's power station which, in your opinion, affect the questions submitted to you." These were the requirements set before the experts.

Now, our readers will have no difficulty whatever in selecting, in their own minds, *the* most capable man in the whole of the South African dominions to report on such a matter as this. We refer, of course, to Mr. John H. Rider. Well, he was one of the experts, and the other was Mr. A. M. Tippett, the chief engineer of the South African railways—a man well known for strict impartiality and straight dealing in all matters, especially those relating to contracts.

These gentlemen constituted what was called the Board of Inquiry, and, for the sake of brevity, we shall refer to them as the board.

The board considered all the tenders and the communications between the tenderers and Prof. Dobson ; they visited the power station and saw the first turbine at work and the second opened up ; they asked for and received information on all the details of the matter ; and they gave a careful, thoughtful, and strictly impartial report on the whole question.

The specification was for one 3,000-KW. alternator with condenser plant, &c., and was issued in October, 1911, by Prof. Dobson. The Board criticises this document, and says that there is no close detail given as to the type required, so that the tenderers are able to submit their standard designs. The specification does not say how much condensing water is available, nor does it give any information as to cable connections, foundations, or switchgear. The chief point seems to be that the symmetrical appearance of the engine room should be regarded, and "that the turbine should be approximately the same height and length as those installed."

Tenderers were allowed 45 weeks for the completion and setting to work of the plant. On the ground that the period asked for was 60 weeks, Prof. Dobson struck out the British Westinghouse Co., but left in the British General Electric Co., who asked for 52 weeks, and the South African General Electric Co., who asked for 48 weeks. The board remarks, in effect, that sauce for the goose should have been sauce for the gander.

Therefore, the board ruled these tenders out, and also all which were incomplete. They were left with three offers, viz., Messrs. Blane & Co. ; Messrs. Reunert & Lenz ; and Messrs. Sykes & Co. ; and they included only for the delivery and erection of the complete turbo-alternator and condenser. They did not investigate questions of switchgear, because Prof. Dobson did not remark on it in his report, and they assumed that he was equally satisfied with all of the offers.

Further, some firms quoted for cable connections, while others endorsed their tenders "Not specified," or "Supplied by Municipality." Hence the board struck this item out of their considerations, recommending that the Corporation should do this work with its own staff.

Spare parts are not detailed, and we have prices varying from £220 to £754 for this item in the tenders of the three remaining firms above-mentioned. This item could not be considered in the circumstances, and was ruled out. Similar considerations applied in the case of the foundations.

On the remaining matters the board wrote a report consisting of 17 pages of type-written matter, with tables and full data for arriving at conclusions, and recommended that the offer of Messrs. Sykes & Co., at the price of £11,812, be accepted.

So much, then, for the report of the board. We do not think it necessary, in a technical journal, to go at great length into this document, although it may seem to interested parties that we are refraining from giving publicity to the board's views. We have not the space to give the report in full, or we would do so. Our readers will know, however, that such men as Messrs. Rider and Tippett will only have given a frank, fearless, and reliable report.

The town clerk of Johannesburg, to whom, as the executive head of the Corporation's staff, the report was sent, took it upon himself to criticise it. His criticism extends over 35 pages of type-written matter, and for a thoroughly bumptious, consequential, and extravagantly absurd concoction we have never seen its equal. We regret more than ever that we cannot give the whole of it in our pages.

It should here be noted that the second turbine broke down in August last, and a claim is still open against Messrs. Reunert & Lenz in respect of liability for this occurrence. The board referred very properly to this circumstance in its report, and this is what the town clerk says, in remarking upon it : "It has to be allowed that the papers and information available to Messrs. Rider and Tippett are of such a nature as would lead them to conclude that Messrs. Reunert & Lenz were entirely responsible for the breakdown. I submit, however, that it is incompetent of them to judge in this matter without knowing what Messrs. Reunert & Lenz have to say on the subject. That information is not yet available to the Council. Until it be established that the accident to No. 2 turbine was caused by mechanical defects, it is improper for the engineers to assume that the Belliss turbine is defective mechanically." We hope these words, which we presume express the considered opinion of the town clerk as the legal adviser of the Corporation, will be duly noted by the manufacturers.

Next, we find this choplogic genius arguing over the meaning of the word "dismantled." They saw No. 2 turbine "dismantled," said Messrs. Rider and Tippett. The town clerk pretends to think that this might lead people to suppose that it was being taken down as useless, and condemns the board's report on this account.

He then goes on to prate of "professional conduct," and the fact that Prof. Dobson's reputation was in their hands. Now the board treated him with quite as much consideration as he deserved, and quite as much as, to judge from our prefatory remarks on the other contracts, he was accustomed to obtain.

Then the town clerk deals with technical matters ! Words fail us to deal satisfactorily with such crass stupidity. Rushing in "where angels fear to tread," he discusses vacuum, steam consumption, and other engineering details, and remarks, "I am more than astonished that Messrs. Rider and Tippett have fallen into these blunders."

The contract went to Messrs. Reunert & Lenz at the price of £12,469. We are not surprised to hear that the feeling out there is so strong that the Government is being asked to intervene. If there is any equivalent of our Local Government Board out there, we shall soon have some lively happenings.

The impudence—there is no other word—of the town clerk and the laymen on the Council who asked for expert advice (on five occasions), and then deliberately flouted it, is almost beyond belief, and such conduct on the part of the so-called representatives of the public interest is absolutely iniquitous. We have always endeavoured, so far as lay in our power, to assist in keeping clean and free from suspicion of evil practices, the municipal government of this country. We have often had to express criticism of this or that action, when possibly the tendency to specialise in the goods of one firm was becoming too pronounced. But the effect of healthy publicity has made short work of such tendencies over here.

In the interests of sound government we are glad of the opportunity, though more than sorry for the necessity, of laying this matter before our readers, and, through them, before the public of Great Britain. If the Corporation of Johannesburg cares at all for its good name; if the town clerk and the engineer care for their good names; if they have any regard for the welfare of the public for whom they are the trustees; if they wish to avoid the suspicion of having been tempted into undue favouritism—they will reconsider this matter, and attend to the recommendations of the eminent men who have not shrunk from facing obloquy and derision to do their best for the public at Johannesburg. The result of it all is, that the wisdom of the remark anent the displaying of precious stones before an inappreciative audience is borne out once more. They "turn again and rend you." Well, the only consolation is, that it was the same sort of audience that "ran violently down a steep place into the sea, and were choked." It is this rushing that we want to stop, and we cordially hope that the Government of the colony will bring the erring municipality to a right feeling.

FIGURES INDISPENSABLE TO MUNICIPAL ELECTRICITY SUPPLY WORKS.

By "INTERESTED."

The most important item, and the one calling for most attention in the business of a municipal undertaking, is a true schedule of all loans and repayments. More often than not the financial working of such trading departments is conducted from the Town Hall, and the staff at the works are usually dependent upon the accountants' office for much information incidental to the proper management of the electricity works. For that reason many stations keep figures for their own guidance, which are more or less duplicates of those at the Town Hall; but generally the works require far more detail than the accountant is able to supply off-hand when requested so to do, and therefore the works records are to be found set out on a much more elaborate scale than those at the finance department. This is necessary owing to the numerous reports and schedules which are frequently asked for by committees, and the information must be readily accessible at short notice. With regard to loans and redemption of capital, careful and constant attention is essential if a true and up-to-date inventory is required. When making application for raising fresh capital, and at the time of a visit by the official auditor, much time and trouble are saved by being able to present detailed particulars of capital expenditure in a clear concise form. The following patterns illustrate one simple method for recording the desired information, which has been in use at a certain London station for many years, and has proved itself quite satisfactory. (See cards Nos. 1 and 2.)

Mortgage No. .....
Amount, £.....
Date .....

Mortgage particulars.				Loan book Fo.	Plant particulars.		Remarks.	Instalment No.	Year.					
									Generating station.			Distributing system.		
Instalment due.	Period.	Rate of interest.	Amount.		Details.	Item No.			Balance.	Interest.	Red'n.	Balance.	Interest.	Red'n.

No. 1.

Mortgage No. .....
Amount, £.....
Card No. .....

Item No.	Year						Year					
	Instalment No.	Generating station.			Distributing system.			Instalment No.	Generating station.			Distributing system.		
		Balance.	Interest.	Redem'n.	Balance.	Interest.	Redem'n.		Balance.	Interest.	Redem'n.	Balance.	Interest.	Redem'n.

No. 2.

Cards are used for this purpose because they lend themselves better to constant handling and reference. At the top of No. 1 are spaces for the number of mortgage or loan, the amount, and the date passed by Council. Below, commencing from the left hand side, will be found columns for date first instalment of redemption is due, the period over which the loan is to be redeemed, rate of interest

COAL ORDER.

Name of Contractor.....*Card No.*.....
Date of order.....*Order No.*.....*Rate per ton*.....
Amount ordered.....*for delivery as follows:*—
.....
Name and class.....

DELIVERIES.

Barge.	Date arrived.	Date cleared.	Amount advised.	Name of weigher.	Amount received.
				Total	

No. 3.

payable on the borrowed money, and the amount of such interest. In the next column, "Loan book folio" means the folio in copy-book where the actual loan application is copied, from which particulars are obtained for entering up the next

Card No......

SUMMARY OF COAL DELIVERIES.

Card No.	Class of fuel.	Description.	Dates delivered.	Quantity received. T.	c.	q.	Amount paid. £	s.	d.
			Brought for'd.						
			Carried forward						

No. 4.

few columns. The illustration shows clearly how this work is set out. By reference to the pattern it will be seen that balances are carried forward from year to year, so that at any time it is possible to see a true statement of affairs. The card also shows the number of instalments repaid, the balance outstanding on the mortgage debt, and the amount redeemed to date, both on account of the generating station and likewise the outside or distributing department.

Where records are retained after this fashion, no trouble whatever should be experienced in finding out at any time exactly how the capital account stands. The information contained in these cards is important in more ways than one,

and will be found to save many hours at times when details are wanted for estimates, reports, &c. Once the figures are collected and set out in the form described, little trouble will be found in keeping them up to date from time to time, and a true statement of capital expenditure is always at hand.

Another very necessary item in the working of a station is a correct detailed statement of coal delivered and on order. I have previously referred to this question in the ELECTRICAL REVIEW, but think the two forms now illustrated will be found original, and will prove useful to those who prefer keeping their particulars on cards rather than in books. No further explanation is needed than the forms themselves, which clearly set out all that is desired. (See cards Nos. 3 and 4.)

COPPER BUYING AND DRAWING: THE ECONOMY OF THE DRAW-BENCH.

By C. V. RAPIER.

THE question whether it pays a firm to put in a draw-bench for drawing copper from rough rolled bar into rounds, flats, commutator bars, tubular connections (from tubes), &c., is often negatived through a too narrow-sighted policy. Firms building turbines will find such a bench capable of drawing the smaller sections of steel turbine blading after they have been run through stamp dies.

The argument invariably used against the draw-bench is that, as very often the machine cannot be kept running, the machine rate of the idle tool and accessories has to be placed to burden account, involving considerable loss.

An explanation of reasons for not keeping the draw-bench constantly employed in a certain works was that, according to the buyer, it seldom paid to draw down existing sections thrown on stock through change of design or other reasons. When the bench was first installed it was used for drawing down some stock sizes which did not seem likely to be utilised for some little time, but this old copper had been bought when prices were high, and as the original price on the stock-card was not in any way reduced, the addition of factory cost of drawing to the same produced a rather high final cost. This figure was entered in the material cost of the machines for which the copper was used, raising the total factory cost of machine; and this gave rise to criticism resulting in the condemning of the draw-bench, as an uneconomical part of the shop equipment. The fact was that if the original price of the stock copper used had been written down to the existing basis price prevailing, there would have been at least equality of cost and certainly a distinct gain in date of delivery; this latter item in particular escaped notice at the time.

The advantages of redrawing copper in stock, and likely to remain there for any reason, are: (1) Decreasing amount of capital tied up to a minimum; (2) quicker delivery to factory than could be obtained from outside. And these advantages are to be reckoned even when the basis price at the time of drawing plus the factory cost (labour plus burden charge) of drawing is greater than the price of similar bars from supplier.

The whole question is one for a "live" purchasing agent to keep after and decide whether it would be advantageous to pay and get delivery or pay less and wait longer. With the aid of the system made possible by the existence of a "Copper Difference Account," his task would be a very light one. In one modern concern, the draw-bench exists:—

1. To obtain quicker delivery of standard sizes to shops than could otherwise be obtained in certain cases. Such copper would be rarely cheaper and often slightly dearer in final price than if it were bought outside.

2. To draw special sizes and lengths, which can thus be supplied to shops very much quicker and considerably cheaper than could be done outside.

3. To reduce stock carried in stores of sections out of use through change in design, errors, or other causes; such sections would be drawn down to standard sizes.

4. By virtue of the existence of a "Copper Difference Account" described hereinafter.

With regard to the general situation in an up-to-date firm, copper is bought systematically and supplied to the shops in a methodical manner permitting the economical employment of a draw-bench. This firm belongs to the H.C.A. (High Conductivity Association) which is, of course, a combine of firms in the copper trade with reference to the sale of rough-rolled and finished drawn copper. The membership is limited, confidential and conditional to an agreement of secrecy. The advantages of this membership are:—

1. Copper can be bought at a reduction of the H.C.A. (not market price) basis price of $\frac{1}{8}$ of a penny per lb. (in England.)

2. Special rebates on "extras" are allowed to members, the amount of similar sizes and kinds of copper bought regularly being the main determining factor in the granting of such rebates. A typical case would be (*a*) an all-round reduction on "extras" to $1\frac{1}{2}$d. per lb. on commutator sections instead of the quoted list price of 8d., 6d., 4d., 3d., or 2d., as the case might be; (*b*) a reduction of £3 per ton ($\frac{3}{8}$d. per lb.) less basis, for hot-rolled soft bars.

By "extras" is meant the extra price per pound to be added to the basis price for the manufacture of "basis" copper into the finished article—rod, wire, strip or bar, as the case may be.

The difference in prices for a firm in the H.C.A. from what any other concern outside the "ring" would be charged, may be best illustrated by taking some actual figures: (1) Ingots (metal market prices); (2) soft hot-rolled bars (H.C.A. and other bases); (3) drawn (finished price—"basis" plus the "extra").

(1) Ingots	£64	5	0	per ton.
Add for rolling per ton ...	10	0	0	
	£74	5	0	per ton price (basis) for hot-rolled bars, or $7\frac{3}{16}$d. per lb.
(2) Add for drawing to bars ...	14	0	0	per ton, or $1\frac{1}{2}$d. per lb.
(3) Subtract $\frac{3}{8}$d. per lb. (basis reduction H.C.A.)	1	3	4	per ton.
	£87	1	8	to H.C.A. member.

To an outside firm, even with the "extras" taken at 2d. the price would be £92 18s. 4d.—a difference of £5 16s. 8d. The above figures represent the prices as on January 3rd, 1910.

It would pay very few firms to lay down plant for the commercial rolling of soft bars from ingots, so we can dismiss this matter from consideration and confine ourselves to operations subsequent to the purchase of soft hot-rolled bars, etc. These could be bought as seen above at a rebate of £3 per ton (given above as £74 5s.); therefore, a firm in the H.C.A. on January 3rd, 1910, could have purchased soft hot-rolled copper for draw-bench use for £71 5s. per ton or $7\frac{3}{16}$d. per lb., whilst the price to outsiders would have been $7\frac{13}{16}$d. per lb.

Now, taking the most difficult case for the draw-bench to make itself pay, viz., commutator bars—if a firm has a rebate on "extras" it is evident that as the soft hot-rolled bars can be bought at $7\frac{3}{16}$d. per lb. and as finished drawn commutator bars can also be bought at $9\frac{13}{16}$d. per lb. the difference of $2\frac{3}{8}$d. per lb. is the drawing cost; this the draw-bench factory cost must not exceed, in order to compete.

It is, therefore, a comparatively simple matter to see right away by trial whether the draw-bench pays or not, apart from its value in giving quick delivery. It is only necessary to see if the factory cost of drawing per lb. can be made equal to, or less than, the extras on suppliers' lists if the rebate on soft hot-rolled copper is allowed to the firm.

Results of such trials should be carefully recorded, where drawing was cheaper, and where dearer, and after the "shop" or tool side of the question had been carefully sifted, data could be accumulated which would be exceedingly valuable to the buyer.

If it so happens that special sizes or other reasons determine the policy of using a draw-bench, then to permit of buying hot-rolled bars in quantities it will probably be found necessary to install a small, simple type of roll for the rough reduction or breaking down of large sections; this would also greatly facilitate the use of old stock sections.

Copper Difference Account.—Even if the matter of purchasing and drawing copper be settled as described above, there still remains a disconcerting item to account for, viz., the daily fluctuation of price of copper.

This problem is satisfactorily solved at some works by the institution of a system of book-keeping known as the "copper difference account," which is based on the fact that there is a standard works basis (conventional price) known sometimes as the "shop basis."

This basis when copper was high, say, in 1908, might have been fixed at 1s. per lb. The figure would have probably been reduced to 8d. by 1910. This basis is treated absolutely like the regular H.C.A. basis and "extras," &c., are added thereto.

The account has a substantial reserve fund to be distributed monthly to the various sections of the works to cover discrepancies, and which would be diminished *pro rata* by a rise in copper or increased by a fall. Being run in parallel with the burden accounts, it is conceivable that too great a surplus might be diminished by crediting a portion to some burden account and *vice versa*.

It would be absolutely necessary to introduce such a scheme before using a draw-bench, otherwise the trouble outlined at the commencement of this article would be sure to ensue.

With regard to the figure to be chosen as the commencing basis, a minimum would appear to be 6½d., and a maximum 14½d.; the mean between these figures, or about 10½d., would appear a logical figure to adopt at the outset.

To this basis the "extras" for sizes would, of course, be added, and the figure would be treated in all respects as a regular basis. It will be readily appreciated how convenient such an arrangement would be, and what a help to the purchasing and accounts departments.

BUSINESS NOTES.

Consular Notes.—Palestine.—In a Consular report just issued, the British Consul at Jerusalem states that in the course of 1911 the concession for the establishment of a water supply and for electric tramways and lighting, was put up to competition, and according to the best information locally available at the time of writing, was awarded to a certain Monsieur Fouquian, of Constantinople, said to have been the only applicant. Some doubt is now felt as to whether the matter has after all really been definitely settled. In any case nothing has, as yet, been done locally.

Russia.—The British Consul at Batoum reports that telephonic communication was established during 1911 between Tiflis and Baku, and is expected to bring in a handsome revenue to the State. The standing telegraph poles were used for the purpose, and should this State enterprise prove a financial success, the system, it is reported, will be extended to other towns of the Caucasus. Wireless telegraph communication between Batoum and Sebastopol and a radio-telegraph station at Petrovsk for wireless telegraphy with Fort Alexandrovsk in Trans-Caspia were installed during the year.

The British Vice-Consul at Baku reports that a concession for electrifying the tramways of the town has been taken up by a Belgian firm, but requires confirmation before any work in connection with its realisation can be proceeded with. Dealing with the general trade of the district the Vice-Consul states that it is noticeable that imports from abroad are generally on the decline. At one time Russia depended to a great extent upon other countries for her machinery and general manufactured supplies. She has now many excellent works and factories of her own, and is able to manufacture goods for use in the country with excellent results; hence the reason for the decline referred to. Each year makes this more apparent, but, despite it, many imported commodities still find a profitable market in the country. A great demand exists for engines working on crude oil as fuel. Most of the oil producers of Baku are now dismantling their boiler installations and erecting electric plants for power purposes. Keen competition between electric and other power is the result. Oil motors are holding their own at present, but it is difficult to say what the ultimate issue is likely to be. The best internal combustion engines at present sold in the Baku market are undoubtedly those of British makes. Their only disadvantage is in price, which is comparatively high, and often disproportionately in excess of the advantages to be derived from their use. Foreign competitors, by having the heavier and coarser parts manufactured in Russia (payment of freight and duty on which are consequently avoided), and only importing the more intricate and complex parts of their machinery, are able to furnish this class of machinery to the Baku market at lower prices than British manufacturers ask. It would be advisable for British manufacturers intending to do business with Baku in motors of the description referred to, to make several practical trials and tests with crude oil actually received from the Baku fields. Internal combustion engines and motors would also sell well in Trans-Caspia and the agricultural districts of the Caucasus, where they are much used for driving cotton machinery, mills and irrigation plant. Excellent motors are now made entirely in Russia. They are cheaper than the foreign-made article, and have met with certain success in the Baku market.

Holland.—The British Consul at Rotterdam reports that a private firm has entered into a contract with the town authorities for the lease of a plot of waste ground in close proximity to the Maashaven to the extent of 17,940 sq. yards, for the storage and handling of bulky articles. Electric loading and discharging cranes will be erected on the shore, and will be so constructed as to enable goods to be discharged from the ocean steamers into barges alongside. The construction of the quays for the support of the necessary heavy machinery will involve an outlay of £33,000.

Nicaragua.—The British Consul in Nicaragua reports that American trade there has been making great and rapid progress during the last few years. Its success may be attributed, in the first place, to the proximity of the United States, and consequent cheaper freight and quicker communication. Besides this, American manufacturers are ready to supply at moderate prices certain lines of machinery and tools, which, although not of very lasting or solid construction, are well fitted for their purpose, and consequently find a ready market. It is frequently urged by American manufacturers that in many classes of machinery, especially agricultural implements and labour-saving devices, improvements in construction are of such frequent occurrence that it is better policy to turn out a cheaper though, perhaps, not so durable article that can later on be replaced by a new model. The superiority of British machinery is very generally recognised, but, for reasons of expediency and cheapness, inferior goods get the preference. The longer and easier terms of payment generally granted by foreign houses, and greater enterprise in sending out commercial representatives, may also largely account for the existing state of things. Nicaragua does not seem to have attracted British enterprise to any considerable extent. A large amount of foreign capital is invested directly or indirectly in the coffee industry, whereas British capital appears to be more largely represented in mining concerns. The imports of machinery in 1910 were as follows:—

From United States		£10,953
,, United Kingdom		8,037
,, Germany		1,053
,, France		28
,, Italy		159
Total		£20,230

Canary Islands.—The British Consul reports that the wireless telegraphy stations lately erected at Santa Cruz de Tenerife, and Gando, Grand Canary, were opened to the public on November 27th, 1911. They are under the management of the Marconi Co. The station at Melenara was completed about the middle of 1911, and has proved of great use to the port and shipping, but it is to be regretted that its advantages are not more generally appreciated, and its use thereby extended. However, it is anticipated that general business will increase in the near future.

Spain.—The British Vice-Consul at Vigo reports that the city electrical tramway scheme, which was considered to be a failure, has now been revived. A new company, with a capital of 2,000,000 pesetas, has purchased the Government concession, and there is every probability that this enterprise will now be pushed forward. A new company has started with works for the supply of electric light to the towns of Corcubion, Cea, Noya, Muros, and Santiago. The water power to produce the energy is obtained from the waterfalls of the River Ezaro.

Price Increase in Germany.—Circulars have been issued by a number of firms engaged in the light electrical engineering branches (telephony and telegraphy) in Germany announcing an increase of 10 per cent. in prices from May 15th, in consequence of the advance in the cost of raw materials. Among the firms concerned are the Siemens & Halske Co., the Felten and Guilleaume-Carlswerk, Mix & Genest, J. Berliner, and the Lorenz Co. An improvement in the sale prices of heavy electrical engineering manufactures is also reported to have taken place in Saxony in the course of the present year.

A Bombay Electrical Trade Association.—We read in the April *Indian Textile Journal* that a movement was recently commenced amongst leading firms interested in electrical trades in Bombay to form an Electrical Trades Association. A preliminary meeting was held and a Committee appointed to draw up a scheme for the conduct of such an Association. When what are considered to be suitable rules have been formulated, a meeting of representatives of all firms concerned will be called to discuss the scheme, and it is fully anticipated that an Association will be formed.

Trade Announcements.—MESSRS. ELLIOTT BROS. have moved their London office to Central Buildings, Tothill Street, Westminster, London, S.W. The works address will remain as heretofore—Century Works, Lewisham, S.E.

MESSRS. W. CHRISTIE & CO. have removed to more commodious and central offices at 105, St. Vincent Street, Glasgow. New telephone number: "Central 1066."

Private Meeting. — Frederick Lewis Mitchell (trading as F. L. Mitchell & Co.), ironmonger and electrical engineer, 58, Peckham Rye, and 188, Rye Lane, Peckham, S.E. The creditors interested herein were called together on May 22nd, when a statement of affairs was presented showing the position as at May 14th last. The ranking liabilities amounted to £1,285, of which £1,012 13s. 5d. was due to trade creditors, and £96 13s. 4d. to cash creditors. There were fully secured creditors for £52 and partly secured creditors for £282. The assets were estimated to realise £715 from which had to be deducted £122 for preference claims, leaving net assets of £593, or a deficiency of £692. The deficiency was chiefly accounted for by losses on trading. The debtor started in business for himself about nine years ago with a capital of £460. He then took an unexpired lease of premises at Peckham Rye at a rental of £70 per annum. The business in Rye Lane was purchased about two years ago. On behalf of the debtor an offer was made of a composition of 6s. 8d. in the £, but it was decided that a Deed of Assignment should be executed, and a committee of five of the principals was also elected. The following are creditors:—

Armorduct Co.	£35	Smith, J. & W. B.	£63
Evered & Co.	34	Schoen Bros.	26
Jagon, W. H.	24	Baker & Crockett	68
General Electric Co.	20	Carron Co.	34
Needham, Veall & Tyzack	50	Currie, Thompson & Co.	16
Hoofs & Rowland	21	Faulkner, Herbert & Co.	34
Krupka & Jacoby	18	Farmiloe, T. & W.	22
London & Continental Electric Stores	16	Falk, Stadelmann & Co.	37
Phillips, J.	25	Nettlefolds, Ltd.	19

The Horticultural Exhibition.—The lighting of the large tents erected in the Chelsea Hospital Gardens for the recent Royal International Horticultural Exhibition, also that of the grounds themselves, was done by a large number of electric lamps. Current was provided by means of a 300 to 400-H.P. engine and dynamo.

Book Notice.—In the quarterly magazine *Advertising* (101, Fleet Street, E.C.) there is an article by Edmund Olander entitled "The Great White Way," in which some pictures and notes are given relating to the use of large electric signs for advertising purposes in New York City, and the possibilities of London in the same connection.

Holidays.—The London and South-Western Railway Co. have published their fourteenth annual official illustrated guide, containing a list of hotels and other establishments which provide accommodation for visitors. More than eighty of the most attractive places on the company's system are mentioned in the descriptive matter, which the editor, Mr. W. T. Perkins, has again brought up-to-date. The list of golf links approached by the L. and S.W. train and steamship services has now reached the large total of 120. Copies may be obtained from the department of Mr. Henry Holmes, superintendent of the line, Waterloo Station, or at any booking office.

Meter Contracts.—The Edinburgh Corporation has accepted the tender of the Bastian Meter Co., Ltd., for five ampere meters, and Govan Corporation that of the same company for three ampere meters.

Liquidations.—Horsfall Destructor Co., Ltd.—Mr. Justice Joyce, in the Chancery Division on May 22nd, appointed a Receiver and manager of this company. The appointment was made on the application of Mr. H. E. Wright on behalf of Parr's Bank, who were holders of debentures for £10,000, and he stated that the company was not a losing concern, and last year made a profit of £4,500. It had several contracts in hand, but heavy judgments had recently gone against them, and they were consequently in financial difficulties. No opposition was offered, and his Lordship made the appointment.

Canadian British Engineering Co., Ltd.—This company is winding up voluntarily, with Mr. P. J. Hellis, 3, Merthyr Terrace, Castlenau, Barnes, as liquidator.

Harper Electric Piano Co., Ltd.—A meeting is to be held on June 25th at 23, Devereux Court, Strand, W.C., to hear an account of the winding up from the liquidator (Mr. H. Wilson).

Catalogues and Lists.—The British Prometheus Co., Ltd., Salop Street Works, Highgate, Birmingham.—The company have issued a pamphlet containing a full illustrated account of the electric kitchen in Marylebone, of which a description has already appeared in our pages. The brochure is really a reprint (by permission) of part of the pamphlet prepared by the Marylebone electricity department a few months ago, but it contains a number of additional pictures of the Prometheus equipment. We believe that the contents are calculated to be useful to the prospective cooking consumer, and copies can be obtained by those interested on application.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E.—Small illustrated folding list, relating to "Silvertown" petrol-electric plant for country house lighting, and giving prices of same.

The Crosby Steam Gage and Valve Co., 147, Queen Victoria Street, London, E.C.—A 12-page pamphlet has been issued illustrating and describing a new method of obtaining reduced steam pressure. A separate regulator, actuated by a relay, is coupled to a balanced valve fitted in the steam main. The same system is being successfully used for surplus and excess pressure valves, and the relay regulator can also be used for actuating dampers, blast gates, electric speed regulators, and other similar devices. The pamphlet further illustrates the firm's differential reducing valve for obtaining very low pressure, in which the diameter of the outlet is twice that of the inlet, the valve being the size of the inlet. By the use of this valve it is possible to obtain reduced pressures right down to vacuum. Fan engine regulators for induced draught plants, and a horizontal controller working on the relay principle, are also included in the list.

Messrs. Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—20-page booklet entitled "The Artificial Lighting of Low-roofed Factories," containing a brief description of the Union "Eye-Comfort" electric system for interior lighting, and a number of photographic reproductions of factory and other premises lighted on this system.

Mr. C. Schniewindt, Neuenrade.—Leaflet showing, and giving prices of, a number of electric flat-irons.

The Electric Construction Co., Ltd., 9, New Broad Street, London, E.C.—Eight-page pamphlet containing illustrated information respecting the "N.P.M." self-starting two or three-phase motor, parts being shown, also views of applications of the motor to the driving of sand mills and grinding machines. Diagrams appear relating to various classes of application, ordinary and special.

The Armorduct Manufacturing Co., Ltd., Farringdon Avenue, London, E.C.—We have received advance copies of a new electric ventilating fan leaflet, which is being issued. Illustrations, brief information, and tabulated price particulars, are given for D.C. and A.C. desk and bracket fans, porthole type exhaust fans, ship and railway fans, &c.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.—Several leaflets relating to D.C. and A.C. oscillating fans, lampholder fans, H.V. distributing fuseboards ("Savetime" and "Competition" types), also "Sun" electric ovens.

The British Thomson-Houston Co., Ltd., Mazda House, Upper Thames Street, London, E.C.—A new folder has been issued, entitled "The Necessity for Scientific Reflectors." It covers the Holophane (glass) and Mazdalux (metal) reflectors supplied by the company, giving the usual data and prices of the reflectors, and some notes on the need for, and value of, a scientific reflector. Copies of this folder (No. 2,278), overprinted with name and address, may be obtained on application.

Mesopotamia.—An American Consul says that the Turkish Imperial Government has approved the concession granted by Bagdad Municipality to Mr. Shabunder to build a tramway from Moazzem to Garara, and that Mr. Shabunder left for Europe recently to contract for material and engineers. The same Consul reports that Bagdad municipality has also opened bids for installing an electric lighting plant, and the army post has been considering introducing a telephone system all over the city.

LIGHTING and POWER NOTES.

Aberystwyth.—The T.C. has invited the Chiswick Electricity Supply Corporation to tender for public lighting, either for the whole of the town or specified streets, for three or five years.

Argentina.—At an extraordinary general meeting of shareholders of the Cia. Franco-Argentina de Electricidad, held on April 30th, the sale of the company to the Cia. Anglo-Argentina de Electricidad was approved.

Negotiations are on foot for installing electric light in the town of Tornquist, Province of Buenos Ayres.

Blackburn.—The Corporation electricity works have obtained their first large customer for electric driving at the new mill in Whalley New Road, of the Great Harwood Commercial Co. The individual drive having been decided upon, each of the 1,040 looms to be installed in the shed will be fitted with a small motor for that purpose.

Broadstairs.—The U.D.C. has accepted the tender of the Isle of Thanet Electric Tramways and Lighting Co., Ltd., for lighting the sea front by flame arc lamps, at £10 per lamp per annum.

Burnham (Somerset).—The U.D.C. proposes to have the Esplanade lighted by means of 12 200-C.P. electric lamps, and other parts of the town with lamps of various candle-power through the supply of Dr. Purves.

Chester.—At a meeting of the T.C., the Special Sub-Committee appointed to decide the question of the electricity undertaking charges, reported that it had decided to recommend the Council to adopt the previous recommendation of the Finance Committee, viz., "That Mr. J. F. C. Snell, consulting engineer, London, be engaged to report upon (1) the mode of charging the tramways undertaking for current supplied, and (2) the mode of charging for the public lighting in the city, at an inclusive fee of 50 guineas." An amendment, however, was moved and carried, that the matter be deferred until the next meeting of the Council.

Continental Notes.—Bavaria.—An electricity generating station is being established in connection with the Gustav Lignite Mines at Dettingen for the supply of electrical energy for lighting and power purposes in the Hanau district.

Hungary.—The municipal authorities of Agram are interested in a scheme to establish a large electricity generating station at Sveto-Nedelja to utilise certain available water-power for lighting and power purposes. The installation is estimated to cost £32,000.

Darwen.—The Corporation electricity works are to be extended by the installation of a turbo-generating set and motor-generator at an estimated cost of £4,850, and mechanical stokers at a cost of £400.

Erith.—The U.D.C. has decided to supply current to the L.C.C. for the sewage outfall works at Crossness, for three years at the following rates:—Lighting, 1½d. per unit between one hour before sunrise and one hour after sunset; 4½d. per unit for other periods. Power, on a sliding scale, with a minimum annual payment of £110.

Festiniog.—The North Wales Power and Traction Co., Ltd., has applied to the B. of T. for permission to utilise overhead lines for the transmission of current at a pressure of 9,500 volts in the parish of Festiniog (Merionethshire), for the purposes of supply under the Act.

Fifeshire.—The Fife Electric Power Co. has again made application to Kirkcaldy District Committee of the County Council, to be allowed to erect overhead wires on four level crossings on the new line which they intend to open between Red House and Freuchie, a distance of nine miles. At a recent meeting the Committee had refused the request. Mr. Thomson, the manager of the Power Co., pointed out that it was purely for an electrical reason that they wished to keep the wires overhead. He also stated that the wires would be carried double across all public roads, and would be well protected, while the company would take the responsibility for any accident. On the understanding that the company would enter into an obligation to repair all damage, the Committee decided to accept a notice of motion for next meeting, suspending its standing orders so as to rescind its previous decision.

India.—The *Indian Textile Journal* says that the result of the investigation which has been undertaken with a view to determining the feasibility of securing in Mysore a supply of electric power at sufficiently low cost to render possible a future smelting industry, is awaited with interest. There is little doubt of the ample resources of the State in regard to supplies of ore, flux and charcoal, and all that seems needed for the utilisation of these materials in the manufacture of steel is cheap power. Pending a satisfactory report concerning the latter, the State geologist and other officials are watching the development of electric smelting in other countries.

The Lahore electric supply scheme is making good progress, and when the mail left the machinery obtained from the Delhi Durbar installation had been placed in position. House connections will be made during the summer months, and it is probable that the works will be formally opened in the coming month by Sir Louis Dane.

Keighley.—The T.C. has decided to apply to the L.G.B. for a loan of £1,660 for a new water-tube boiler for the electric light works.

Lancaster.—The Corporation Electricity Department reports an income of £9,708, compared with £9,231 in the previous year, and a decreased expenditure of £383. Although lighting current produced £33 less, motive power was more by £444, notwithstanding a reduction of £67 on tramway supply. The net profits were £1,348, against £488 last year, and £161 more than anticipated. £800 was voted to the relief of the rates, and the balance, £548, to the credit of the reserve fund, now £2,865. The capital expenditure is £63,252, and the outstanding debt £51,531, with £3,622 set aside for depreciation.

Linthwaite.—The U.D.C. has consented to the Huddersfield T.C. erecting an overhead line in the town for the supply of current to residences and a place of worship in the district.

London.—A large electrically-driven pumping plant, which is being installed by the Port of London authority for raising the level of the water in the Royal Victoria and Albert Docks, consists of three Allen 70-in. centrifugal pumps, with a capacity of 280,000 gallons of water per minute, driven by Westinghouse motors. The suction culvert to the pumps is 14 ft. sq., and six 50-in. delivery pipes are provided.

Oldham.—The profit on the electricity department for the year ended March 25th last was £2,047, against £1,300 in the previous year. There had been increased receipts from lighting of £1,579, and £998 from power, but there was a decrease of £1,128 on traction supply. It has been decided by the Committee that the balance of £1,300 on the year ended March 25th, 1911, should be placed to reserve fund. The suggested extension of the electric lighting cables to Moorside, at a cost of £2,585, is under consideration.

Peterborough.—The working of the Corporation electricity department shows a gross surplus of £4,289, and of £629 after providing for interest on, and repayment of loans. This compares with £369 net surplus last year, and a considerable deficit (largely owing to an expensive arbitration) the year before. The total capital expenditure on the undertaking has amounted to £58,402.

Perthshire.—In regard to the projected Loch Ericht Water and Electric Power Bill for Perthshire, it is now stated that the promoters have cancelled all the clauses giving them power to dam or interfere in any way with Loch Ericht. Therefore, the water power will now be developed from the River Ericht, which is wholly on the Menzies estate. The Bill will not be likely to meet with any opposition in Parliament, and is to be taken up immediately.

Port Glasgow.—Further correspondence between Port Glasgow T.C. and the Greenock Corporation, relative to the latter supplying certain power users in Port Glasgow with electricity, has been considered by the T.C. It was agreed that the proposal for the supply of electricity must be considered as a whole, and the necessary agreement for consent submitted. The Council objected to the inclusion in the B. of T. order of premises proposed to be supplied for lighting purposes in John Wood Street, as it understood the supply to be given under the order was to the power users in the burgh only.

Portrush.—At a special meeting of the Council a report was made on the proposal of Messrs. Miller, Wilson & Pegg, electrical engineers, Belfast, to do the engineers' duties in connection with the lighting scheme, at 5 per cent. on the contract prices. A proposition to this effect was defeated, however, and the majority decided to advertise for other tenders, those in favour of this course explaining that they were not against the firm mentioned, but wished to have a larger field of choice.

Rugby.—At the last meeting of this Council, the electricity accounts for the year ending March 31st last were presented. These showed an apparent loss of £250 on the year's working, but Mr. Dewar, the chairman of the Committee, explained that about £800 had been paid towards capital expenditure, but for which and other outgoings there would have been a balance to revenue account of nearly £1,200. Mr. Dewar added that during last year 82 new connections were made, bringing up the total number to 514.

Southport.—Following the amalgamation of Birkdale with Southport, the Traders' Association recommended the Southport T.C. to consider the purchase of the Birkdale Electric Lighting Co.'s interest in Greater Southport, and also the Southport and Birkdale Tramway Co.'s interest in the amalgamated area. The matter has been referred to a Special Committee, consisting of the members of the Parliamentary and the Finance Committees.

Stourbridge.—The Midland Electric Corporation for Power Distribution, Ltd., announces its intention to lay cables in Heath Street and Norton Road, Stourbridge, for the supply of current for lighting, power, heating and cooking.

Swindon.—The T.C. has applied to the L.G.B. for a loan of £6,050 for mains, feeders, and services, for five years.

Taunton.—The T.C. has decided to offer the National Electric Construction Co., Ltd., £500 in full settlement of all claims under the free wiring agreement. The company had asked one-half of the original cost for the installations, viz., £793.

West Hartlepool.—The L.G.B. has sanctioned a loan of £38,000, applied for by the T.C. in connection with the proposed power development at the Seaton Carew Iron Works.

TRAMWAY and RAILWAY NOTES.

Asiatic Turkey.—The representatives of the British European Trust, Ltd., have concluded a convention by which they have obtained from the Imperial Ottoman Government a concession to construct a system of tramways in and about the city of Smyrna. Negotiations are also taking place for the acquisition of telephone and power concessions for the same city.—*Financier.*

Bradford.—The Tramways Committee has under consideration a proposal to extend the tramways from Allerton to Wilsden.

Chile.—The Government has requested Congress to give preferential attention to the question of the electrification of the railway from Valparaiso to Santiago, as also other lines.—*Review of the River Plate.*

Continental Notes.—France.—A concession has lately been granted for the construction and working of a system of electric tramways in the town and district of Montlucon (Department of Allier).

A scheme for the conversion of the local steam railway between Bordeaux and Camarsan to electric traction is at present under consideration.

Halifax.—The Tramways Committee has decided to purchase six new cars and to carry out further doubling of the track on the Skircoat Green and Sellon sections. It was also agreed to open negotiations with Bradford with a view to instituting a through tramway service between the two towns.

Japan.—We learn from Tokio that a scheme is under consideration to establish a garden city about five miles from Kodzu, with which town it would be connected by an electric tramway.

Lancaster.—Alterations have been agreed upon to the track at King Street Corner, amounting to £85. The traffic

revenue last year was £5,566—an increase of £315. Traffic and general expenses were similar to last year; power, £67 less; and repairs, £101 more. The total expenditure was £8,181. The income on revenue account exceeded the expenditure by £305, making the net deficit, after paying interest and redemption, £2,379, the smallest yet experienced. The capital expenditure is £43,412, and the debt redeemed, £12,371.

Maidstone.—Councillor Green, deputy chairman of the Tramways Committee, on Wednesday last week appeared on a car with tickets and punch, serving as a volunteer conductor, and had to submit to a good deal of chaff. The conductors had ceased work as a protest against the dismissal of one of their number, who had been their spokesman in an agitation for increased wages. The Corporation was willing to grant the increase, but not to reinstate the conductor, and his comrades refused to go back without him.

Middlesex.—An arrangement has been made between the County Council and the Finchley District Council, it is stated, for the removal of the electric tramway standards in the centre of the Great North Road between Highgate and Whetstone.

New Zealand.—The report of Mr. F. Black, the consulting engineer, on the Timaru tramway scheme, has now been presented. The estimated capital expenditure for track, overhead equipment, rolling stock and car-shed is £57,000, the estimated revenue in three years' time is £11,812, and the working expenses £10,417, leaving a balance for depreciation, &c., of £1,395. The report also compares the alternative sources of supply, *i.e.*, whether the borough should purchase energy from the Government Hydro-Electric Supply, to be generated at Lake Coleridge, or install its own generating plant. The Government department offers to supply in bulk at 11,000 volts at a charge of £6 10s. per H.P. per annum based on the average demand ascertained from the maximum half-hourly consumption. The engineer estimates that, unless the above rate is reduced to £5 10s. per H.P., it will be more economical for the borough to run its own generating plant, with the prime movers either suction-gas engines or Diesel engines. The estimated costs of the three alternatives, based on the present growth of the town and population, and assuming that the equipment will be completed in three years' time, this also being the time that will elapse before the Government supply is available, are as follows:—Sub-station reducing H.T. supply to direct current, £10,900; producer gas plant, £20,560; Diesel engine plant, £24,200. The report is very favourable to the Council's proceeding with the scheme, and it is also probable that the borough will buy over the present lighting plant, which is owned by a private company.

The poll of the Napier ratepayers has resulted in sanction being given to the raising of an additional £10,000 loan for the tramway and lighting scheme; this increased expenditure is the extra cost of material and labour since the first estimates were presented.

The town of Inglewood is about to raise a loan of £8,500 for electric lighting work.

Perth.—According to a report submitted to the Corporation Tramways Committee, the receipts for the year ended May 15th amounted to £9,394, which constitutes a record, being £499 better than last year. The expenditure has been kept below the estimate by £140.

Rhondda.—The employés of the Rhondda Electric Tramways Co., numbering over 200, struck work on Friday last week. The company, apparently, does not intend to attempt to run cars while the strike lasts, and a long stoppage is expected.

South Shields.—The annual report on the Corporation tramway undertaking by Mr. L. E. Harvey, the manager, showed a gross profit of £14,505, which was the largest amount yet received. After paying interest on capital, sinking fund charges, &c., the net profit balance was £5,663. This is an increase of £3,319 over the previous year, and is the largest net balance yet realised by the undertaking. The traffic receipts showed an increase of £3,113 over the previous year. The receipts per car-mile were 9·71d., an increase of ·871d. The working expenses showed a decrease of £66. The consumption of energy per car-mile was 1·11 units. The Committee recommended that £500 should be handed to the insurance fund, and the remainder (£5,163) be placed to the credit of the reserve fund, making it £14,633.

Southend-on-Sea.—The T.C. has applied to the L.G.B. for a loan of £3,800 for the provision of additional loops and sidings on the Pier tramways.

U.S.A.—By its agreement with the Interborough and Brooklyn Rapid Transit Companies for new subways, New York City has committed itself to an expenditure of £24,800,000 during the next five years, the two subway companies finding £54,000,000.

TELEGRAPH and TELEPHONE NOTES.

Durban.—Durban, says an American Consular Report, has the only municipal telephone system in the Union of South Africa. All others are owned and operated by the Union Government. The number of telephones in use is greater here in proportion to population than in any other town in the Union from which figures are available, the following being a comparison of several of the larger towns on July 31st, 1911:—

	White population.	Number of telephones.
Durban	32 000	1,928
Johannesburg	122,000	3,450
Cape Town	30,000	1,400
Pietermaritzburg	14,000	874

Durban is also the only city of the Union of South Africa which uses American telephones. All other cities use the Ericsson, a Swedish telephone. Durban's revenue from telephones in the fiscal year 1911 was $88,162, of which $21,384 was surplus over expenditures.

Glass Poles for Telegraph Work.—It is stated that glass poles are now being manufactured for telephone and telegraph service. The glass is strengthened by interlacing and intertwining it with strong wire threads. It is claimed that poles of this kind show their superiority over wooden poles in their resistance to the ravages of insects in tropical climates and to the effects of rain, snow and sleet in other climates.—*Electrical Review and Western Electrician.*

Imperial Wireless Telegraphy.—In reply to questions regarding the confusion and lack of secrecy observed in the transmission of wireless messages at the time of the disaster to the *Titanic*, Mr. H. Samuel recently stated that there was no reason to suppose that confusion would occur in the transmission of long-distance wireless telegrams with a wave-length specially reserved for them under a properly regulated system. At present, he said, the secrecy of wireless telegrams was mainly dependent on the use of cipher or code.

International Radio-Telegraphic Conference.—The British representatives at the forthcoming International Radio-Telegraphic Conference are to be Sir H. Babington Smith, Mr. E. W. Farnall, Mr. R. J. Mackay, Mr. F. W. Home, Commander F. G. Loring, Capt. E. F. B. Charlton, Commander W. R. W. Kettlewell, Lieut. John A. Slee, Lieut.-Col. J. M. W. Macdonogh, and Major R. H. H. Boys. Australia, Canada, India, New Zealand and South Africa are sending special representatives. The interests of other British Possessions will be looked after by the British delegates.

Mr. Charles Bright, F.R.S.E., will represent the Commonwealth Government.

Japan.—It is stated that the number of applicants waiting for telephones on the books of the Japanese Government Department exceeds 100,000. Parliament is to be invited in its next session to consider a Bill to effect the necessary expansion of the telephonic system at a cost of approximately £600,000.

Night Telegraph Letters.—The Postmaster-General announces that from to-morrow a service of night telegraph letters at a charge of 6d. for 36 words, and ½d. for every three words beyond 36, will be inaugurated between all towns where the head telegraph offices are open all night. They can be handed in up to midnight, or telephoned to the head offices, and will be delivered by the first post next morning.

Portugal.—In addition to an agreement for the erection of high-power stations in various parts of Portugal, the Azores, the Madeira Islands, and the Cape Verde Islands, the Government has arranged with Mr. Marconi for the building of Marconi stations in all the Portuguese Colonies—Mozambique, Angola, Macan, Timor and Novagoa.

U.S.A.—The American Marconi Co. is about to equip stations at New Orleans, at Swan Island, in the Caribbean Sea, and at Santa Marta, Colombia, providing direct wireless communication between the two American Continents.

Wireless Installations on Board Ship.—In reply to a question in Parliament, Mr. Buxton stated that the question of compulsorily installing wireless telegraphy on merchant ships was one of the points which had been referred to the Merchant Shipping Advisory Committee. Certain points in connection with it were at the same time being considered by the Board of Trade in conjunction with the Post Office.

The Dover Harbour Board's flotilla of tugs are to be fitted with wireless telegraph installations, with a range of 100 miles.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—VICTORIA.—June 11th. (*a*) 1,237 electricity recording meters; (*b*) 3 tons 12 cwt. of bare hard-drawn aluminium cables, for the Melbourne City Council. See "Official Notices" May 24th.

Melbourne.—June 18th. 50½ miles of cable, for the P.M.G.'s Department. See "Official Notices" May 3rd.

P.M.G., Melbourne.—July 23rd. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

June 4th.—The Agent-General for Victoria is prepared to receive tenders for certain works in connection with the electrification of the Melbourne suburban railways. See "Official Notices" May 3rd.

TASMANIA.—June 10th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" April 12th.

N.S.W. Government Railways and Tramways.—June 10th and 18th. Steam piping and fittings for Ultimo Power House. June 17th.—Two coal elevators and conveyors, for White Bay Power House. July 1st.—200-kw. motor-generator set for the Ultimo Power House. Specifications from the Electrical Engineer's Office, 61, Hunter Street, Sydney.

Western Australia.—July 31st. P.M.G.'s Dept. Telegraph and telephone material. See "Official Notices" May 10th.

New South Wales.—July 31st. Common battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" May 17th.

South Australia.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" May 17th.

October 1st. — Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" May 24th.

Barnes.—June 11th. Concentric paper-insulated and lead-sheathed cable for the U.D.C. See "Official Notices" to-day.

Belfast.—June 10th. Extension of the lighting and traction switchboards, for the Corporation. See "Official Notices" May 17th.

June 10th.—35,000 tons of coal for the Corporation generating station. Mr. T. W. Bloxam, city electrical engineer.

Bettws-y-Coed.—June 4th. Underground cables, transformer pillars and public lighting apparatus, two water turbines with alternators and pipework, high and low-pressure switchgear and connections, for the U.D.C. See "Official Notices" May 17th.

Bristol.—June 3rd. Arc lamp carbons (No. 122) and incandescent electric lamps (No. 123), for the Docks Committee of the T.C. W. W. Squire, engineer, Cumberland Basin.

June 10th.—Wiring and fittings for electric lighting at Stapleton Workhouse, for the B. of G. See "Official Notices" May 24th.

Buenos Ayres.—The *Review of the River Plate* states that the Government has authorised the Hydraulic Department to call for tenders for the electric installations in the new warehouses, port of Buenos Ayres, group H; also that the Municipality of General Alvear (prov. of Buenos Ayres) will shortly call for tenders for the installation of electric light.

Derby.—One water-tube boiler, for the Corporation Electricity Department. See "Official Notices" May 3rd.

Devonport.—June 8th. Cables, wires and house fuse boxes, for a year, for the Corporation. See "Official Notices" May 17th.

June 13th.—Steam coal (5,000 tons), for the Corporation electricity works. Mr. J. W. Spark, borough electrical engineer, Newport Street, East Stonehouse.

Dewsbury.—June 5th. Steam coal (about 4,500 tons), for the Corporation electricity works. Mr. R. H. Campion, borough electrical engineer, Bradford Road.

France.—June 5th. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of a multiple telephone switchboard for the Telephone Exchange at Roubaix.

June 15th.—The French Post and Telegraph authorities in Paris are also inviting tenders for the supply of a multiple switchboard for the telephone exchange in the town of Tours.

Germany.—June 4th. The Baden State Railway authorities at Carlsruhe are inviting tenders for the supply of 100 kilometres of electric cables.

Gloucester.—Forty-five street-lighting lanterns for high-candle-power tungsten lamps, for the City Electricity Department. See "Official Notices" May 3rd.

Hoylake and West Kirkby.—June 3rd. Coal, for the U.D.C. electricity works, for a year. Mr. Chas. J. Turner, electrical engineer.

Italy.—Ischia di Castro.—Tenders will shortly be invited for the supply of public electric lamps. Particulars from the Concilio Municipale.

Liverpool.—June 4th. Electrical fittings, &c., for a year, for the Overhead Railway Co., Ltd. Mr. E. J. Neachell, general manager, 31, James Street.

London.—June 3rd. Battery boosters and switchboard, for the Westminster Electric Supply Corporation, Ltd. See "Official Notices" May 10th.

Poplar.—June 19th. Renewal of sub-circuit wiring, fuseboards, &c., at the Workhouse, for the B. of G. See "Official Notices" May 24th.

June 8th.—Steam-driven boiler feed pump for the B.C. electricity works. See "Official Notices" to-day.

Hackney.—June 27th. Boiler plant, induced-draught plant, economiser, feed pumps, coaling plant, &c., pipework &c., travelling crane, turbo-alternator, motor-generator or motor-converter, switchgear, &c., for the B.C. See "Official Notices" May 17th.

Hornsey.—June 10th. One electrically-driven turbine feed pump, for the T.C. See "Official Notices" May 24th.

Manchester.—June 3rd. Electricity department. For Stuart Street generating station; electrically-driven coal-conveying plant. Specification, &c., from the secretary, F. E. Hughes, Town Hall, Manchester. Deposit £1 1s. (returnable).

June 5th.—Electricity department. Tenders for annual stores. Particulars and forms of tender can be obtained up to May 25th (in writing only) from F. E. Hughes, secretary, Electricity Department, Town Hall, Manchester.

June 5th.—Washed coal slack, for the Corporation electricity works, for a year. Mr. F. E. Hughes, secretary, Town Hall.

Margate.—June 3rd. Two electrically-driven vertical spindle rotary sewage pumps, with one set of automatic starting and stopping gear, for the Corporation. See "Official Notices" May 24th.

Middleton (Lancs.).—June 12th. Coal, for a year, for the borough electricity works. Mr. S. Pauls, electrical engineer.

Oldham.—June 10th. Steam, exhaust, drain and condenser pipes, oil separator, &c., for the Corporation Electricity Committee. See "Official Notices" to-day.

Penrhiwceiber (Glam.).—June 5th. Electrical fittings for a year, for the Penrikyber Navigation Colliery Co., Ltd. The Secretary, Penrhiwceiber.

Pontypridd.—June 10th. Washed nuts for a year, for the U.D.C. electricity works. Mr. J. E. Teasdale, engineer, Treforest Works.

River Plate.—The *Review of the River Plate* states that the Municipality of San Antonio Oeste, Rio Negro Territory, will shortly call for tenders for an electric light station.

Rochdale.—June 5th. Extra-high-pressure three-phase switchboard, for the Corporation. See "Official Notices" May 17th.

Russia.—Riga.—The Duma delegates are about to bring in a Bill for the construction of the Riga-Cherson Canal (Baltic to Black Sea), the cost of which will be included in the Budget for 1913. The scheme, when completed, will tend to develop the coal and naphtha regions around the Black Sea, and also render Russia independent of the passage through the Dardanelles. It will also afford a favourable opening for manufacturers of electrotechnical and other machinery.—*Zeitschrift fur Elecktrische und Maschinenbau.*

Salford.—June 10th. Electric wiring of Nashville Street Council school. See "Official Notices" to-day.

South Africa.—June 26th. Boksburg. Rolling stock, converter plant and overhead material for the railless trolley system. See reference to this matter in E.R., May 17th.

Spain.—June 6th. The municipal authorities of Caballo (province of Coruna) are inviting tenders for the concession for the electric lighting of the town during a period of ten years.

Cadiz.—June 6th. Tenders are invited by the Ministero del Marina at Madrid for the supply and erection of a revolving bridge in the port of Cadiz. Plans, details of construction and system of working proposed, to be submitted for the approval of the Ministero.

July 2nd.—Electric lighting of City of Oviedo and its municipal buildings for the Municipal Council. Board of Trade Commercial Intelligence Department, London.

Stockport.—June 11th. One or more 1,500-kw. mixed-pressure turbine alternators, for the Corporation. See "Official Notices" May 24th.

Sweden.—June 22nd. Swedish Royal Board of Waterworks. (1) 11.250-h.p. three-phase generator, 10,000 volts, 150 r.p.m.; transformers for raising to 70,000 volts. For State power station at Alfkarleby. Specification, for 15 kr. (16s. 8d.), deposit from, and tenders, to Forestandaren för Kungl. Valtenfallsstyrelsens Elektrotekniska Byra, Stockholm.—*Board of Trade Journal.*

Turkey.—Constantinople.—Supply of telegraph instruments also the needful materials for the erection of telegraph lines. Particulars from, and tenders to, Department of Fortifications, War Ministry. Deposit £T400.

June 15th.—Tenders are invited for the establishment of electric tramways in the Asiatic part of the capital. Particulars, in French, from the Minister of Public Works on forwarding the equivalent of 10s. in Turkish money (half of £T).

Haifah.—The Administration of the Hedschas Railway at Haifah having been called upon to extend their line from Medina to Mecca, tenders will shortly be called for for the rails and fittings, telegraph equipment, &c. Tenders must be submitted through local agents to the Railway Administration either at Constantinople or at Haifah.

Uruguay. — Montevideo. — June 20th. Tenders are invited for the supply and erection of four electric turn-bridges of 1,500 kg. each, with 800 metres of rails, for the Customs warehouses. Terms, &c., Harbour Secretary, Calle Piedras No. 156, Montevideo.

Walthamstow.—May 31st. Stoneware conduits, for the U.D.C. Electricity Department. See "Official Notices" May 17th.

June 14th.—Low-tension switchboard, for the U.D.C. Electricity Department. See "Official Notices" to-day.

West Ham.—June 5th. Refuse destructor and steam-raising plant in connection with the Canning Town generating station, for the Council. Specification (£1, returnable) from the Borough Engineer, Town Hall.

June 17th.—Installation of electric light at the Education Offices, The Grove, Stratford, and Colegrave Road schools, Stratford, for the Education Committee. See "Official Notices" May 24th

CLOSED.

Chester.—In connection with the hydro-electric works scheme, the Corporation has provisionally accepted the following tenders:—

J. Gordon & Co.—Erection of buildings and construction of turbines, £9,960. (Bentley & Co., sub-contractors for buildings.)
Lancashire Dynamo Co., Ltd.—Dynamos, £2,008.
Crompton & Co., Ltd.—Switchboard, £269.

Coventry.—The T.C. has accepted the tender of Messrs. Stewarts & Lloyds, Ltd., for pipework for the electric light works, at £3,055.

Leek.—The U.D.C. has accepted the tender of Messrs. H. & T. Danks, of Netherton, for a Cornish boiler, with fittings, at £123 10s.; and that of Messrs. Goodrich & Hamlyn, of London, for a forced-draught furnace, at £30.

London.—Poplar.—The B.C. Electricity Committee has placed an order with the Western Electric Co., Ltd., amounting to £1,035, for 1,917 yd. of three-core 6,600-volt ·15 paper-insulated lead-covered and jute served E.H.T. cable.

Mansfield.—The T.C. has accepted the tender of the Western Electric Co., Ltd., for mains, &c., for the extension to Mansfield Woodhouse, at £3,624.

River Plate.—The contract for the extension of the electric installation in the National lunatic asylum has been given to Messrs. Duhnkrack, Nellen & Co. The cost of the contract is $93,976 paper.—*Review of the River Plate.*

Southampton.—The T.C. has accepted the offer of Messrs. Ferranti, Ltd., at £57 10s. for the supply of a panel for extending the H.T. switchboard at the generating station.

Southend-on-Sea.—The T.C. has accepted the following tenders:—

General Electric Co., Ltd.—50 Aron current limiters, 8s. 9d. each.
Lucy & Co., Ltd.—Joint, tee and tapping boxes (two years), 2s. 11d. to 9s. 9d. each.
Chas. Mackintosh & Co., Ltd. (two years).—·062 cable, £51 10s. per 1,000 yd.; ·15 cable, £96 per 1,000 yd.
Dussek Bitumen Co., Ltd. (two years).—Bitumen, £5 15s. per ton.
Limmer Asphalt Co., Ltd. (two years).—Insulating compound, 2d. per lb.

Stoker Contracts.—Messrs. E. Bennis & Co., Ltd., have received during the last few weeks, orders for about 100 stokers, which include their three types—sprinklers, cokers and chain grates; also orders for complete sets of coal-handling plant from three important undertakings. "Bennis" stokers are being supplied to the electricity works of Northampton, Stoke-on-Trent, Rotherham and Stalybridge.

Taunton.—The T.C. has decided to purchase from the Tudor Accumulator Co., Ltd., a battery, at £652, and to apply for a loan for this sum. For maintenance the following terms have been arranged with the company:—First and second years, £10 per annum; third and fourth years, £20 per annum; fifth and sixth years, £40 per annum; seventh, eighth, ninth and tenth years, £97 per annum.

Walthamstow.—The U.D.C. has accepted quotations from the Tudor Accumulator Co., amounting to £552, for replating the lighting battery at the generating station to half its normal capacity, and £80 per annum for maintenance for a period of ten years.

Wolverhampton.—The Education Committee has accepted the tender of the District Electric Lighting Co., Ltd., at £302, for the lighting of the new school and centre at Hordern Road

FORTHCOMING EVENTS.

Physical Society.—Friday, May 31st. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "The Calibration of Wave-meters for Radio-telegraphy," by Prof. G. W. O. Howe; and "On the Use of Heaviside's Resistance Operators in Air-Core Transformer Theory," by Dr. W. H. Eccles.

Royal Institution.—Friday, May 31st. At 9 p.m. Paper on "Icebergs and their Location in Navigation," by Prof. Howard T. Barnes, F.R.S.

Thursday, June 6th.—At 3 p.m. Lecture on "X-Rays and Matter," by Prof. C. G. Barkla. (Lecture II.)

North-East Coast Institution of Engineers and Shipbuilders.—Saturday, June 1st. At 2 p.m. At the Wood Memorial Hall, Newcastle. Paper on "The Use of X-Rays in the Examination of Coal," by Messrs. F. C. Garrett and R. C. Burton.

Institution of Mining Engineers.—Thursday, June 6th. At 11 a.m. At the Rooms of the Geological Society, Burlington House, W. Paper on "Safety Devices in connection with Electrical Machinery and Appliances for Coal Mines," by Messrs. D. Bowen and W. E. French; discussion on paper on "Reduction, Control and Collection of Coal-dust," by Mr. S. Mavor; and other papers and discussions.

At 7.30 p.m. At the Waldorf Hotel, W.C. Dinner.

Friday, June 7th.—At 9.40 a.m. (from Fenchurch Street). Visit to the works of the Western Electric Co., Ltd., North Woolwich.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week:—

Monday, June 3rd.—"A" Company. Infantry drill, 7.30 to 9.30 p.m.
Tuesday, June 4th.—"B" Company. Infantry drill, 7.30 to 9.30 p.m.
Thursday, June 6th.—"C" Company. Infantry drill, 7.30 to 9.30 p.m.
Friday, June 7th.—"D" Company. Infantry drill, 7.30 to 9.30 p.m.
Saturday, June 8th.—Officers' Drill Cup Competition (Wimbledon Common). All Companies parade at headquarters at 2.30 p.m. Dress.—Service dress, drill order, with waterbottles and haversacks.

The headquarters will be closed for instructional work from June 10th until further orders.

(Signed) P. H. Campbell, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

NOTES.

Inquiries.—Makers of "Hiko" commutator compound and "Nichrome" resistance wire are asked for.

Test Results on Zoelly Steam Turbines.—The Zoelly steam turbine, manufactured by Messrs. Escher Wyss & Co., of Zürich, and a large number of their licensees in all countries, is one which has a high reputation for low steam consumption and consequently small running cost, combined with a high degree of reliability. The following test results obtained with typical standard machines may prove of interest to our readers; they concern sets of 1,250, 5,000 and 10,000 KW. respectively, coupled in each case to three-phase alternators. The outputs are in the proportion of 1 : 4 : 8.

1. Test result on two 1,250-KW. Zoelly turbines, 3,000 R.P.M., erected in 1911 at the Drammen Electricity Works, near Christiania, Norway; tested February 21st, 1912:—

	Turbine 1.		*Turbine* 2.	
Load	4/4	2/4	3/4	4/4
Output of turbine in KW. including excitation, excluding output for condenser ...	1,275	656	981	1,271
Steam pressure before turbine in lb. per sq. in.	182·4	174·1	174·4	174·1
Temperature before turbine in °F.	588·2	471·2	493·7	523·4
Vacuum at exhaust branch in % (barometer 735 mm.) ...	96·8	98·0	97·3	96·6
Steam consumption in lb. per KW.-hour	12·59	14·79	13·80	13·16

2. Test results on one 5,000-KW. Zoelly turbine, 1,500 R.P.M., erected 1911 at the Electricity Works, Escaut, near Antwerp; January 22nd and 23rd, 1912:—

Load	1/4	2/4	3/4	4/4
Output in KW. including excitation, excluding output for condenser	1,184	3,160	4,305	5,418
Steam pressure before turbine in lb. per square inch ...	169·5	173·8	168·1	166·7
Temperature before turbine in °F....	519·8	558·3	555·8	588·2
Vacuum at turbine exhaust branch in % (barometer 735 mm.)	98·5	97·5	96·9	96·2
Steam consumption in lb. per KW.-hour	14·70	12·65	12·35	11·95

3. Test result on one 10,000-KW. Zoelly turbine, 1,250 R.P.M., erected in 1911 in the power station of La Société le Triphase, at Asnière, France: February 12th, 1912:—

Load...	1/3	4/4
Output in KW., including excitation, excluding output for condenser ...	3,678	10,006
Steam pressure before turbine in lb. per sq. in.	162·6	154
Temperature before turbine in °F. ...	566·6	565·3
Vacuum at turbine exhaust branch in per cent. (barometer 735 mm.) ...	97·2	95·6
Steam consumption in lb. per KW.-hour...	14·55	11·01

The turbines under 1 and 2 were supplied by Messrs. Escher Wyss & Co., Zürich; that under turbine 3 by the Elsässische Maschinenbau Gesellschaft, Belfort. The 1,250-KW. turbine has 8 stages; the 5,000 and 10,000-KW. turbines have 12 single stages each.

Parliamentary.—*Tramway Provisional Orders.*—The first Tramway Provisional Order came before the Examiner on May 16th. It confirms orders in respect of four districts. The Bingley Urban District Council is authorised to construct a tramway, 3 miles 1 furlong in length, from Bingley to Shipley. The Dewsbury Corporation gets authority to construct a tramway in the borough 1 mile 5 furlongs in length. The Portsmouth Corporation is empowered to construct three lines of tramway of 6, 3 and 4 furlongs respectively, and the West Hartlepool Corporation is given power to construct a number of short lengths of line.

Bradford Corporation Trolley Vehicles.—The first Provisional Order Bill ever promoted in regard to trolley vehicles is that of the Bradford Corporation, which was before the Examiner on May 16th. There are five routes scheduled in the order over which it is proposed to run trolley vehicles, and the lengths are as follows:—2 miles 1 furlong 1 chain; 1 mile 5 furlongs 7 chains; 3 miles 2 furlongs 7 chains; 2 miles 1 furlong 7 chains; 4 furlongs 7 chains; and 1 mile 5 furlongs 1 chain.

Institution and Lecture Notes.—Institution of Electrical Engineers (Birmingham Local Section).—The report of the Committee to the annual general meeting, held on May 22nd, for the session 1911-12, shows that the average attendance at meetings has been 88, as compared with 77 last year, and the membership has increased from 418 to 436. The officers for the session 1912-13, besides past chairmen are:—

Chairman—Mr. A. M. Taylor.

Vice-Chairmen—Mr. C. E. C. Shawfield, Dr. W. E. Sumpner.

Ordinary Members of Committee—Messrs. G. Barnard, W. C. Goodchild, M. L. Kahn, W. J. Larke, F. M. Lea, J. F. Lister, D. K. Morris, A. H. Railing, F. W. Schiller, M. Solomon, R. Threlfall and T. F. Wall.

Hon. Secretary—Mr. H. B. Matthews.

Association of Teachers in Technical Institutions.—The sixth annual conference of the Association was held this week at the Polytechnic, Regent Street, under the presidency of Dr. James Clark, Rector of the Kilmarnock Academy and Technical School.

The Society of Engineers (Inc.)—The third annual dinner of the Society was held at the Criterion Restaurant on May 11th, Mr. John Kennedy, the President, being in the chair. The loyal toasts having been honoured, Sir David Gill proposed "The Society" in a felicitous speech, to which the Vice-President responded. The toast of "The Ladies" was proposed by Mr. J. W. Wilson, and acknowledged by Miss Siemens in a very creditable maiden speech. Coffee was served at small tables in an adjoining room during the performance of an excellent programme of music directed by Mr. Charles Capper, which formed a fitting conclusion to a very enjoyable evening.

Institution of Electrical Engineers.—As the result of the ballot for an Associate Member of Council, Mr. A. Bruce Anderson, the Council's nominee, was declared elected.

Institute of Marine Engineers.—On Saturday, May 18th, the Institute paid a visit to the works of the Western Electric Co., Ltd., Woolwich.

Engineers' Prospects in Canada.—Our esteemed contemporary, the *Surveyor*, quotes some very interesting remarks from a letter by Mr. R. O. Wynne-Roberts on the possibilities for engineers in Canada. He has received a number of letters from engineers and others at home regarding appointments on the Regina water scheme, for which he is the engineer; to all he has answered that, under Canadian conditions, it is quite impossible to offer anyone any appointment worth securing, because it cannot be assured that the engineer will adapt himself to the new conditions or be satisfied with the prospects. Canadian authorities are "quite willing to pay for goods if they can be delivered," so if engineers are willing to risk crossing the Atlantic, and to take the rough and the smooth of life, their merits or demerits will be rewarded accordingly. There are plenty of works to be carried out this summer. The railway companies are laying hundreds of miles of new railways, more especially in the West, and the amount of work that will in the near future be carried out between the Atlantic and the Pacific will be immense. But to any aspirant who proposes to visit Canada it should be made plain that the only royal road to success is to be energetic and persevering, and to mind his own business. The tendency of newcomers into any new country is to criticise. Let them take Punch's advice—"Don't." It irritates, it is useless and inane. Hard work is a vastly superior emollient. "Take on," Mr. Wynne-Roberts concludes, "the first offer that fits with your engineering experience. Never mind the pay at the commencement; that will adjust itself as soon as the newcomer proves himself to be capable, reliable and resourceful, for opportunities are plentiful to such men."

A Flame Lamp Celebration Supper.—The purchase of the patents and business of the Beck Flame Lamp, Ltd., by Mr. Billington, was celebrated at a supper given by him to the employés and their wives on Saturday last. The picturesque village inn attached to the works at Hayes was tastefully decorated with an abundance of crimson and white peonies, and the staff specially illuminated it electrically for the occasion. "May we all thrive like bees in a hive, and never sting one another," was the toast given by the landlord, a typical old English innkeeper. The musical programme arranged by the manager, Mr. Elmslie, was greatly appreciated. At the close of the evening, Mr. Billington thanked the staff, men and boys for their unswerving loyalty to him, and paid special tribute to his "friend and manager,' Mr. Elmslie. He referred to the licence granted to the Foster Engineering Co. to manufacture Beck lamps, which he was convinced would prove an admirable arrangement; it necessitated the drafting of some of the men to Wimbledon. Those who remained, he felt sure, would, under their capable and popular foreman, Mr. Bloomfield, cheerfully engage in every fresh enterprise. He would continue to be keenly interested in their welfare, and wished them all every success and happiness. The evening ended with the singing of "He's a Jolly Good Fellow" and "Auld Lang Syne."

Electrical Engineers' Sports.—On Friday last the London Electrical Engineers (Territorial Force) held their fourth annual athletic sports at Stamford Bridge grounds. The programme included seven events, and all the first prizes were won by four men:—

100 Yards Race.—Final heat: Spr. R. J. Wimberley, 11⅕ sec.
Long Jump.—Spr. R. J. Wimberley, 17 ft. 7 in.
880 Yards Race.—Second-Corpl. J. Mitchell, 2 min. 15 sec.
120 Yards Hurdle Race.—Spr. E. R. Hutt, 21 sec.
440 Yards Race.—Spr. G. M. Drake (holder), 60 sec.
High Jump.—Spr. E. R. Hutt, 4 ft. 11in.
One Mile Race.—Second-Corpl. J. Mitchell, 5 min. 10 sec.
The programme also included inter-company tug-of-war pulling.

The officials were: Referee, Major A. E. Le Rossignol; judges, Major J. H. S. Phillips, Capt. K. W. E. Edgcumb, Capt. T. Rich, Capt. W. H. Merrett, and Lieuts. H. M. Edmunds, W. E. Hammerton F. H. Masters, H. C. Tufnell, and E. T. Busk; timekeeper, Capt. T. H. Campbell, R.E.

Detection of Icebergs.—Experiments have been carried out by Prof. H. T. Barnes, F.R.S., director of the Physics Department of McGill University, Montreal, on the detection of the presence of icebergs with the aid of a micro-thermometer capable of automatically recording a change of temperature of 0·001°. The instrument is towed in the water, and its indications are recorded on a chart. The characteristic sign of the neighbourhood of ice is first a rise in temperature followed by a sharp and steady fall. It is stated that icebergs were thus detected at a distance of two or three miles during a voyage from Halifax to Bristol recently. Prof. Barnes will lecture on the subject at the Royal Institution to-night.

Electric Light for the House of Commons.—Reporting on the proposal to substitute electric light for gas in the House of Commons, Dr. Collins says:—"The proposed electric lighting is to be effected by groups of three metal-filament incandescent lamps. The rays from the lamps will be filtered by passage through three layers of glass, that covering the lamp itself, a Holophane globe, and an ornamental pane of glass. The ultra-violet rays will be cut off by the amber colour of the ornamental pane. There is, therefore, no fear that the eyesight of members of Parliament will be affected by ultra-violet rays." Even clear glass is opaque to ultra-violet rays, so there need be no apprehension on this point.

Engineering Bequest.—The Superannuation Funds of the Institutions of Civil and Mechanical Engineers stand to gain £2,500 each under the will of the late Mr. T. P. Reay (Kitson and Co., Ltd., Leeds). Under the same will, the income on £10,000 will go to the establishment of "Reay Scholarships" for engineering students at Leeds University.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. A. E. Wilson, the deputy city electrical engineer, of Bristol, was the recipient last week of a handsome silver cigar box, which was presented to him by the members of the staff of the electricity department on the occasion of his marriage. The presentation was made by the general manager, Mr. H. Faraday Proctor.

Mr. G. C. Milnes, electrical engineer, Lancaster, has had his salary increased by £25, with a further similar advance to follow next year.

The Leek U.D.C. has increased the salary of the electrical engineer by £25 a year.

General.—Mr. H. B. Renwick, formerly secretary of the Bournemouth and Poole Electricity Supply Co., Ltd., has been elected to a seat on the board, and appointed managing director. Mr. W. D. Brightman has been appointed secretary and Mr. F. C. McQuown has been appointed London secretary. We are also informed that Mr. Renwick, who was formerly general manager and secretary of the Richmond (Surrey) Electric Light and Power Co., Ltd., has now been elected to a seat on the board of that company and appointed managing director. Mr. F. C. McQuown has been appointed secretary.

The "Marriages" column of the *Times* on May 28th contained the following announcement:—"Cooke—Bonnevie.—On May 24th, 1912, at the English Church, Christiania, by the Rev. G. E. Mooney, Conrad William Cooke, M.I.E.E., to Sophie Augusta, elder daughter of the late Chief Advocate August Bonnevie, of Christiania, and of Wilhelmina Bonnevie (*née* Ingstad), his wife."

A River Plate exchange says that MR. A. SAL, chief engineer to the Post and Telegraph Department, has been appointed technical adviser to the Argentine Legation at the Wireless Telegraphy Convention in London.

We are informed that MR. LEON GASTER is now making a tour on the Continent to further the progress of the illuminating engineering movement. Mr. Gaster is acting as delegate of the Illuminating Engineering Society to the International Congress for the Prevention of Industrial Accidents, which closes to-day at Milan, and at which he is contributing a paper on "The Value of Good Illumination as Regards Health and as a Means of Preventing Accidents."

Obituary.—SIR EDWARD ALBERT SASSOON, who died on May 24th, will best be remembered, says the *Times*, for his great interest in the means of telegraphic communication between India and this country. "His efforts led to the appointment of Lord Balfour's Departmental Committee in 1901. The report only accepted some of his proposals, but he persevered with his campaign, and many letters of his on the subject appeared in our columns. Sir Edward saw successive and substantial reductions in cable rates and improved facilities, and, though he was modest in his estimates of himself, he was gratified with the public tributes he received for his substantial share in securing them. Wireless telegraphy was another of his subjects. Its advantages so much impressed him that he introduced a Bill, which, however, shared the usual fate of private members' Bills, to make a wireless equipment compulsory in the case of passenger vessels."

MR. S. M. JONES.—The death occurred on May 23rd, at Cardiff, of Mr. S. Mansel Jones, electrical engineer, who was in business at Castle Street, Cardiff, and Wind Street, Swansea.

GERMAN ENTERPRISE IN SOUTH AMERICA.

THE report of the German South American Telegraph Co., of Cologne, states that at the company's suggestion a banking group closely associated with the undertaking acquired about 80 per cent. of the share capital in the Compania Telegrafica-Telefonica del Plata, of Buenos Ayres, about the end of 1911, and thus secured control of this enterprise. The latter owns telephone and telegraph cables between Buenos Ayres and Monte Video, and is also interested to the extent of one-half of the share capital in the Compania Telegrafica-Telefonica Nacional, of Buenos Ayres, which maintains connections between Buenos Ayres and Rosario. It has been arranged that the German South American Telegraph Co. shall take over the shares from the banking group at cost price by the year 1914 at the latest, and until the time for acquisition has arrived the former has guaranteed to the latter that the dividends on the shares shall yield interest of a minimum of 6 per cent. per annum on the monetary outlay incurred, although the Argentine company has distributed an average of 13 per cent. in the past five years. The transaction has assured the German South American Co. of a connection between Uruguay and Argentina, so that the necessity for acquiring a cable concession in Argentina and Uruguay for communication between these two countries has been avoided. It is estimated that the total expenditure on taking over the shares and effecting technical improvements in contemplation will amount to £125,000.

NEW COMPANIES REGISTERED.

Talgarth Electric Supply Co., Ltd. (122,131).—This company was registered on May 21st, with a capital of £1,500 in £1 shares (500 cumulative preference, 500 preferred ordinary and 500 ordinary), to carry on the business indicated by the title. The subscribers are:—J. H. Edwards, Springfield, Saltford, Somerset, electrical engineer, 50 shares; A. A. Douglas, Brendon, Colwyn Bay, manufacturer, 50 preference shares. Private company. Table "A" mainly applies. Registered office, Electricity Works, Talgarth.

Cirencester Electric Supply Co., Ltd. (122,004).—This company has been registered with a capital of £6,000 in 500 cumulative preference shares of £5 each and 1,500 preferred ordinary and 2,000 ordinary shares of £1 each, to carry on the business of an electric lighting and power company in all its branches. The subscribers (with 50 shares each) are:—J. H. Edwards, 127, Victoria Street, Bristol, electrical engineer; S. Williams, All Saints' House, Bristol, solicitor. Private company. J. H. Edwards is first managing director; qualification, 50 shares. Registered by Seymour, Williams and Co., 38, Parliament Street, S.W.

Intenso Patentees and Manufacturers, Ltd. (122,037).—This company was registered on May 16th, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers of appliances connected with artificial light, burners, lamps, brackets, globes, films, shades, glasses, meters, galvanometers, ammeters, voltmeters, carbons, cut-outs, switches, batteries, &c., and to adopt an agreement with C. Stephens and T. Clayton. The subscribers (with one share each) are:—A. W. West, 124, Strathyre Avenue, Norbury, S.W., clerk; A. J. Button, 2, Edwin Street, Gravesend, clerk. Private company. The number of directors is not to be more than five; the first are not named. Registered office, Mill Works, Roden Street, Ilford, Essex.

Yorkshire Waste Heat Co., Ltd. (122,107.)—This company was registered on May 20th with a capital of £100 in £1 shares, to carry on in Yorkshire or elsewhere the business of an electric light, electric power, and power gas supply company in all its branches, and to adopt agreements (1) with the Old Silkstone Collieries, Ltd., for the *(inter alia)* acquisition of a freehold plot of land in Barugh, York; and (2) with the Yorkshire Electric Power Co. for *(inter alia)* the erection of a generating station at Barugh aforesaid; and (3) an indenture of lease with the said Power Co. The subscribers (with one share each) are:—A. C. Lupton, Springwood, Roundhay, near Leeds, cloth manufacturer; H. Barran, Shadwell Grange, Moortown, Leeds, clothier; R. Armitage, Farnley Hall, Leeds, ironmaster; W. G. Jackson, Bramham Hall, Boston Spa, colliery proprietor; A. H. M. Thompson, Roundhay, Leeds, engineer; W. B. Woodhouse, Greenhow, Moortown, Leeds, engineer; J. J. H. Stansfield, Lee Lane, Horsforth, near Leeds, chartered secretary. Minimum cash subscription, seven shares; the number of directors is not to be less than three; the first are A. G. Lupton, H. Barran, R. Armitage, W. G. Jackson and A. H. M. Thompson. Registered offices, Calder Road, Thornhill, Dewsbury, Yorks.

British Economical Lamp Co., Ltd. (122,110).—This company was registered on May 21st, with a capital of £10,000 in £1 shares, to carry on the business of suppliers of electricity, electrical engineers, manufacturers of electric lamps and fittings, &c., and to adopt an agreement with J. Kohler. The subscriber (with one share each) are:—J. Kohler, 9, Old Bailey, E.C., merchant; R. Niepel, 9, Old Bailey, E.C., merchant. Private company. The number of directors is not to be less than two or more than four; the first are R. Niepel (managing director and chairman), and J. Kohler; remuneration of R. Niepel, as managing director, £500 per annum. Registered office, 9, Old Bailey, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Johnson & Phillips, Ltd. (84,968).—Issue on April 29th, 1912, of £4,000 debentures, part of a series of which particulars have already been filed.

Electromobile Co., Ltd. (75,139).—Issue on April 29th, 1912, of £160 10s. debentures, part of a series of which particulars have already been filed.

Royce, Ltd. (68,871).—Memoranda of satisfaction (*a*) in full on or before March 23rd, 1911, of debentures issued between May 4th, 1903—October 7th, 1904, securing £25,000, and (*b*) in full on or before March 31st, 1912, of debentures dated March 23rd, 1911, for securing £13,000, created and issued in discharge *pro tanto* of the said debentures securing £25,000, have been filed.

Bryant Trading Syndicate, Ltd. (67,051).—Debenture dated April 15th, 1912, to secure £24,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. B. James, 8-9, Broad Street Avenue, E.C.

"Z" Electric Lamp Manufacturing Co., Ltd. (96,594).—Issue on May 3rd, 1912, of £3,000 debentures, part of a series of which particulars have already been filed.

Minehead Electric Supply Co., Ltd. (74,382).—Deed dated April 20th, 1912 (supplemental to trust deed dated Dec. 22nd, 1909, securing £500 debenture stock), charged on freehold property in Quay Lane, Minehead, forming part of North Hill Building Estate, leasehold property in Marsh Lane, near Alcombe, Somerset, with electric generating station and offices thereon, and company's other assets, present and future, including uncalled capital (subject to mortgage dated November 28th, 1907). Trustees: T. Joyce and F. Risdon, Williton, Somerset.

Samuel Hartford & Co., Ltd. (116,148).—Debentures dated May 4th, 1912, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. E. B. Woolright, Holly Bank, 15, Hargreaves Road, Liverpool.

Hill, Harding & Co., Ltd. (108,926).—Issue on April 13th, 1912, of £150 debentures, part of a series of which particulars have already been filed.

Oriental Telephone and Electric Co., Ltd. (40,691).—A memorandum of satisfaction to the extent of £2,400 on April 24th, 1912, of trust deed dated June 28th, 1905, and deed of acknowledgement dated June 12th, 1907, securing £200,000 debenture stock, has been filed.

Corona Lampworks, Ltd. (116,527).—Issue on May 8th, 1912, of £3,500 debentures, part of a series of which particulars have already been filed.

British Mica Co., Ltd. (72,187).—Return dated March 18th, filed March 21st, 1912. Capital £5,000 in 2,000 preference and 3,000 ordinary shares of £1 each; 629 preference and 2,000 ordinary shares taken up; £629 paid on the preference; £2,000 considered as paid on the ordinary. Mortgages and charges: Nil.

W. J. Furse & Co., Ltd. (121,420).—Particulars of £5,000 debentures, created April 26th, 1912, filed pursuant to Sec. 93 (3) of Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Altrincham Electric Supply Ltd. (40,795).—Particulars of £30,000 debentures, created by resolutions June 7th, 1898, and April 18th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £5,000. Property charged: The company's undertaking and property, present and future. No trustees.

Anglo-Norwegian Aluminium Co., Ltd. — Mortgage on 1,989 shares of a Norwegian company called Aktieselskabet Nigeland Brug, and mortgage to which the company is entitled on the property (land) of the said company, dated May 10th, 1912, to secure advances not exceeding £15,000, interest at 6 per cent., and bonus of £1,000. Holders: Vivian Younger & Bond, 27, Leadenhall Street, E.C.

Newcastle and District Electric Lighting Co., Ltd. (28,022). —Return dated April 11th, filed April 18th, 1912. Capital, £800,000 in £10 shares. All shares taken up. £297,300 paid, leaving £2,700 in arrears. Mortgages and charges: £250,000.

Newcastle-upon-Tyne Electric Supply Co., Ltd. (27,997).— Return dated April 10th, filed April 18th, 1912. Capital, £1,500,000 in 150,000 ordinary and 150,000 preferred shares of £5 each. 137,500 ordinary and 137,500 preferred shares taken up. £5 per share called up on 139,529 ordinary and 126,741 preference. £1,281,350 paid. £98,150 considered as paid on 7,571 ordinary and 10,759 preferred. Mortgages and charges: £687,500.

Mather & Platt, Ltd. (60,387).—Return dated March 13th, filed April 4th, 1912. Capital £1,000,000 in 40,000 preference shares of £10 each and £600,000 ordinary shares of £1 each. All shares taken up. £10 per share called up on 29,200 preference and £1 per share on 25,000 ordinary. £317,000 paid. £683,000 considered as paid on the remainder. Mortgages and charges: Nil.

County of Durham Electrical Power Distribution Co., Ltd. (61,591).—Return dated April 10th, 1912. Capital £500,000 in £5 shares (50,000 preferred). All shares taken up. £500,000 paid. Mortgages and charges: £250,000.

I. Frankenburg & Sons, Ltd. (67,889). — Return dated February 20th, filed March 12th, 1912. Capital £250,000 in £10 shares (12,500 ordinary and 12,500 preference); 10,093 ordinary and 10,010 preference shares taken up. £10 per share called up on 593 ordinary and 10 preference: £6,030 paid; £195,000 considered as paid on 9,500 ordinary and 10,000 preference. Mortgages and charges: £15,000.

Hove Electric Lighting Co., Ltd. (36,942).—Return dated March 20th, 1912, capital £100,000 in £5 shares (15,000 ordinary and 5,000 preference). All shares taken up; £100,000 paid. Mortgages and charges: £44,600.

Folkestone Electricity Supply Co., Ltd. (51,825).—Return dated April 18th, filed May 1st, 1912. Capital, £110,000 in £5 shares. All shares taken up. £100,000 paid. Mortgages and charges: £100,000.

Crystal Palace Kearney High-Speed Railway Syndicate, Ltd. (113,126).—Return dated January 13th, filed March 22nd, 1912. Capital £30,000 in £1 shares (29,000 preference and 1,000 deferred). 1,447 preference and 100 deferred shares taken up. £1,340 paid on 1,347 preference, leaving £7 in arrears. £200 considered as paid on 100 preference and 100 deferred. Mortgages and charges: Nil. List of allotments made up to April 1st, 1912, shows a further 340 preference shares allotted, payable in cash.

Ellis & Ward, Ltd. (107,215).—Return dated March 18th, 1912, filed March 2 rd, 1912; capital, £10,000 in £1 shares; 6,003 shares taken up; £8 paid; £6,000 considered as paid. Mortgages and charges: Nil.

Madras Electric Tramways (1904), Ltd. (80,361).—Return dated March 28th, 1912; capital, £200,000 in 25,000 preference and 15,000 ordinary shares of £5 each; 11,500 preference and 11,452 ordinary shares taken up; £5 per share called up on 5,000 preference; £25,000 paid; £89,760 considered as paid on 6,500 preference and 11,452 ordinary. Mortgages and charges: £62,730.

Incandescent Heat Co., Ltd. (81,371).—Return dated December 1st, 1911, filed April 13th, 1912. Capital £120,000 in £1 shares; 116,436 shares taken up; £1 per share called up on 21,436; £21,448 10s. paid, including £12 10s. on 250 forfeited shares; £95,000 considered as paid on 95,000 shares. Mortgages and charges: Nil.

Acton Lamp Co., Ltd. (110,486).—Particulars of £3,000 debenture stock, created by resolutions of March 19th and April 1st, 1912, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 19 8, the amount of the present issue being £1,400. Property charged: The company's undertaking and property, present and future. No trustees.

Everett, Edgcumbe & Co., Ltd. (84,764).—A memorandum of satisfaction to the extent of £1,000 on May 15th, 1912, of debentures dated June 9th, 1905, securing £10,000, has been filed.

Foots Cray Electricity Supply Corporation, Ltd. (86,863). —Issue on May 13th, 1912, of £450 debentures, part of a series of which particulars have already been filed.

Pritchetts & Gold, Ltd. (69,517).—Return dated March 20th, filed March 21st, 1912. Capital £45,000 in £1 shares (25,000 preference); original capital, £40,000 in 20,000 preference and 20,000 ordinary shares of £1 each (increased to present amount in January, 1911); 24,907 preference and 20,000 ordinary shares taken up; £1 per share called up on 20,997 preference, 6d. per share on 4,000 preference, and £1 per share on 3,000 ordinary; £24,004 paid, leaving £3 in arrears, £17,000 considered as paid on 17,000 ordinary shares; mortgages and charges: Nil.

CITY NOTES.

Hindhead and District Electric Light Co., Ltd.

THE directors' report, to which we made brief reference last week, showed that cables had been laid to Shottermill Ponds, and to the "Seven Thorns" in Portsmouth Road. A cable is to be laid as far as the Fernden Estate, and within the next few months the supply will be run through this estate to Marley Heights. Applications from Frensham have not come in sufficient numbers to justify making the extension this year. The report refers to the fire at the generating station at Hindhead and the engineer's house in May, 1911. Thanks to the efforts of the consulting engineers and the staff, with the generous assistance of other companies, the company were able to resume the lighting of Hindhead after two days, and Haslemere after five days. So far as can be ascertained, the fire was due to the ignition of celluloid batteries, which were being charged during the night. It was at once decided that in future no battery should be charged at the station. The generating station had been restored and enlarged and made practically fireproof, and increased dwelling accommodation had been provided, so that two engineers now live upon the premises. There had been installed new up-to-date switchboards, a battery double the capacity of the old one, and the engines and dynamos had been thoroughly overhauled and restored. It was proposed to write off the whole of the loss caused by the fire. Under these circumstances the directors had not set anything aside this year for depreciation. Owing to the fire and temporary loss of day load, the income for 1911 was only £116 more than in 1910, although they supplied 39 new consumers. During the year £1,250 had been received on account of share capital, and further debentures amounting to £200 had also been issued. The net profit, after deducting all expenses, amounted to £1,781. The final dividend for last year had been paid. An interim dividend of 2½ per cent., debenture interest and income-tax had been paid, the fire loss written off, and £10 put to bad debt account. After bringing in the balance from last year there remained a balance of £821. The directors recommended a final dividend of 3 per cent. (making a total of 5½ per cent. for the year), absorbing £533, and leaving a balance of £288 to carry forward. (The dividend for 1910 was 6 per cent., and £282 was carried forward.)

Urban Electric Supply Co., Ltd.

MR. P. D. TUCKETT (chairman) presided on Wednesday at Salisbury House, E.C., over the annual general meeting of the above company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 851), said the accounts showed steady progress, the profits earned at the various works being increased by £3,597. This was not as large an increase as the results for the first quarter of the year led them to hope they might have realised, but it was not unsatisfactory, being an increase of over 7½ per cent. As against this, the administration expenses were increased by £870, owing to the expiry of the guarantee and the new arrangement with Edmundson's, under which they paid them a fixed sum of £2,000 a year. Also, owing to the expiry of the guarantee, the net profit and loss account had assumed a new form; instead of showing the guaranteed dividends on the one side with the corresponding guaranteed deficit on the other, they now showed the item "interest on outstanding accounts due to the contractors," with a balance of net profit carried down to the balance-sheet. The former depreciation provision under the contract also disappeared, whilst the provision for redemption of debenture stock appeared for the first time. Deducting this and the interest charges, there was an available net profit of £15,438, out of which, after appropriation of £10,000 to reserve for depreciation, they recommended the payment of a 2 per cent. dividend for the year on the preference shares, leaving a balance of £438 to be carried forward. As they knew, a scheme of capital reduction was approved in the early part of this year, and under its terms the balance of the 5 per cent. dividend on preference shares would be satisfied by the issue of funded dividend certificates. Turning to the balance-sheet, the capital expenditure had increased by £68,606, the bulk of the expenditure having been incurred in connection with the Cornwall and Twickenham undertakings. To meet this expenditure, the debenture debt had been increased by £52,658, and the debt due to the contractors by £14,887. The items "Preliminary Expenses," "Discount and Stamp Duty on Debenture Stock issued" and "Suspense account for loss on wiring and motors on hire and plant dismantled" appeared for the last time, as they would be written off next year against the £160,000 by which their capital had been reduced. From this time forward the balance-sheet should disclose a steadily improving position. In addition to the very much more ample reserve for depreciation which they were now making, there would be a growing debenture stock redemption fund, whilst the two items of "instalments received in redemption of capital expenditure on wiring and motors on hire," which was partly a reserve provision, and "Amount received from consumers *re* mains," would increase from year to year. Moreover, as long as they were able to apply the annual provision for the redemption of debenture stock in purchasing such stock on the market at a discount, the profit resulting from the transaction would constitute a further reserve provision. This year the profit so realised amounted to £733, and it had been applied in reducing the item of "Discount on debenture stock issued." The only item which appeared superficially to be somewhat unsatisfactory, and was likely to remain, was the debt due to contractors, but, as they knew, the liquidation of that debt was provided for by contract, and it could at any time be satisfied by the allotment of debenture stock, principally in the form of second debenture stock. Their lamp connections still continued to show a progressive increase. During the year they connected the equivalent of 64,577 33-watt lamps—a 12 per cent. increase as compared with increases of 8 per cent., 9 per cent. and 10 per cent. for the three previous years. A large part of this increase was attributable to Cornwall, and 69 per cent. of it represented power. The lighting connections, however, also represented an increase of 13 per cent. on those for the previous year, which was most satisfactory, considering that with metal-filament lamps they required to connect three times the candle-power to give them an equivalent connection in watts compared with carbon lamps. The proportion of the power to the lighting business was steadily rising. Four years ago 65 per cent. of their connections for the year represented lighting, and only 35 per cent power, whereas last year the propor-

tions were reversed, power representing 69 per cent., as against 31 per cent. only for lighting. The output for the past year increased by 2,410,425 units, from 8,785,732 to 11,196,157, a 27 per cent. increase, for which, as in the case of the lamp connections, Cornwall was principally responsible, the power and heating units representing an increase of 40 per cent., as against an increase of less than 5 per cent. in the lighting units. For some years now the lighting output had shown a comparatively small increase owing to the influence of the metal-filament lamp, and there was no doubt that they still continued to feel the effect of the change from carbon to metal-filament lamps, although it was difficult to say how far last year's results were affected by this cause, and how far by the exceptionally fine weather which they experienced throughout the summer. The fine weather unquestionably exerted a marked influence on the output, and it was, therefore, fortunate that they were able to counteract this feature by so substantial an increase in the power output. Every year the innumerable advantages of electric driving were coming to be increasingly appreciated, and as long as trade remained good, they were likely to continue to benefit by this development. In particular, their Cornish power business was developing most satisfactorily, although, as he told them a year ago would be the case, its beneficial results were reflected in last year's accounts to a comparatively small extent. The demand for power was, however, altogether exceeding their expectations, and was, indeed, increasing with such inconvenient rapidity that their difficulty was to provide the plant to deal with it. He did not know that he could yet say anything very definite as to the possibilities of a cooking load, but during the past year every effort had been made to stimulate interest in the subject of electric cooking, and, so far as kettles, toasters, and other small apparatus was concerned, with some considerable success. Anything like a general adoption of electricity for cooking purposes must necessarily be a matter of gradual growth, since there was naturally a great deal of prejudice and innate conservatism to be overcome, but those of their consumers who had adopted it as their regular and normal method of cooking, and quite a few had done so, were, he believed, entirely satisfied with the results, so that he felt pretty sure it was only a question of time for this to become an important feature of their business. He did not propose to analyse the results realised at the various towns set out in the table in the report, but it might be well for him to say a few words with reference to their experiences during the past year, as they afforded a very good illustration of the impossibility, owing to the influence of extraneous circumstances, over which they had no control, of forecasting or ensuring the results of any particular year. Thus, they began last year with one of the best quarters they had had for some time, and consequently with the promise of a bumper year. No sooner had they entered on the June quarter than they began to feel the effect of last year's phenomenal summer, with the result that their combined profits for the three latter quarters of the year were considerably below those for the single March quarter. Their profits for the September quarter, partly owing to the dislocation of business due to the railway strike, actually showed a small decrease on those for the corresponding quarter of the previous year. When fine weather kept people out of doors in the evening or delayed their lighting up by perhaps half an hour, its influence on the output was most marked, and this, combined with the influence of the metal lamp economy which they undoubtedly still continued to feel, was only partly offset by the comparatively small annual percentage of new business. If, for instance, new connections represented 10 per cent., which was a fair increase, a corresponding increase in the output was entirely swamped by a reduction of anything over 1 per cent. in the general output. This showed how narrow was the margin between increase and decrease, and he, therefore, thought they had no reason to be dissatisfied with the results for the past year. For the first quarter of the current year they had connected the equivalent of 21,804 33-watt lamps, as against 10,864 for the corresponding period of last year, an increase of over 100 per cent. 84 per cent. of these connections represented power. They had sold an additional 1,034,761 units, a 38 per cent. increase, the lighting output having increased 4·6 per cent., and the power 59 per cent. The profit increase, though substantial, was not in proportion, partly because it compared with an exceptionally favourable March quarter last year, and partly because this year they had suffered from the effects of the coal strike. Not only had they had to pay more for their coal, but its quality had been inferior. They would, however, be glad to know that in spite of the difficulties which the strike entailed, they were able to maintain an uninterrupted supply at all their stations. For the remaining quarters of the year it was more than usually difficult to forecast their prospects. Unless they had a repetition of last year's weather conditions, the two summer quarters should compare favourably with last year's, whilst their Cornish power load was bound to bring in a substantial increase of profit. On the other hand, the prevailing industrial unrest was bad for their business equally with others. They were faced with the certainty of dearer coal, the burden of the Insurance Act would fall on them during the latter half of the year, and the general tendency was for all expenses to increase. Whilst less confident, therefore, that their growth of profits this year was likely to attain the handsome proportions which, but for these untoward features, he thought they might have expected, he had no reason to doubt that their profits would show a substantial and healthy increase. Owing to the many disturbing factors which might at any time upset their most careful calculations, he felt it increasingly difficult to promise them a particular result for a particular year, but that the business was a stable and progressive one, and that the trend of profits would be steadily upwards he had no doubt whatever.

Mr. F. E. Gripper seconded the motion.

Mr. Chasseran asked whether the renewals and repairs were charged to revenue; and if it would not be possible to print in the report a statement of the expenses of the different concerns in which they were interested. He also pointed out that the capital expenditure during the past year had earned very little, and suggested that the board should be very careful in regard to further capital expenditure.

The Chairman said the shareholders need have no anxiety as to the renewals and repairs being charged to revenue. In addition to the £10,000 put to depreciation they had also placed aside £4,846 for the redemption of debentures which was a far more substantial provision compared with the past, and was a substantial provision on its merits quite apart from any question of the past. He did not think they needed more tables in the report, as the figures already given were very full, and to add to them would be to unduly burden the report. Any shareholders could, however, on application, have the accounts of the concerns in which they were interested. It was quite true that the capital expended had not earned what they would like, but they would get the benefit of that expenditure in future. He remembered some time ago when Mr. O'Brien pointed out that the expenditure on the Caterham undertaking only earned 1½ per cent., but now it was earning close on 5 per cent. They were making a slow but steady forward movement. The electric lighting industry was one of the safest and most stable businesses when once built up, but in the small towns the progress must necessarily be slow.

The report was adopted.

The retiring director and auditors having been re-elected,

The Chairman moved, and Mr. Charrington seconded, a hearty vote of thanks to the staff.

Mr. W. J. Finnes, as a shareholder, expressed his pleasure at hearing such a resolution moved by the board, because it was really the officials on whom the success of a company depended, although they did not always get the credit acknowledged from the directors' side of the table. Personally, he would include the directors in the vote, for they had had a straightforward speech from the chairman, and, he believed, straightforward dealings by the whole board.

The motion was carried.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors' report for the past year (according to the *Times*) states that the profits show a satisfactory increase over those of 1910, the amount brought to the credit of profit and loss account from Kalgoorlie being £24,290, compared with £18,106 in the previous year. The sum of £7,500 has been added to reserve for depreciation and renewals, bringing that account up to £30,500. Provision has also been made for the 2 per cent. premium payable on the redemption of the 6 per cent. first mortgage debentures. In February a violent cyclone did considerable damage to the plant and transmission lines, completely stopping operations, and entailing much loss to revenue. The cost of restoring the plant to its former state of efficiency is estimated at £2,280. In view of the serious loss resulting from this misfortune the directors are unable to recommend the payment of a dividend on the ordinary shares.

Cape Asbestos Co., Ltd.—The report for 1911 states that the trade of the company during the year under review, notwithstanding the bad tendency still prevailing in the asbestos industry, has been satisfactory. The directors have registered a separate Italian company, under the style of Capamianto Società Anonima Italiana, at Turin, which company has taken over the assets and liabilities of the Italian branch. The accounts show a net profit of £5,005, which, added to the credit balance brought forward, £1,855, leaves available for appropriation £6,861. The directors recommend the *pro rata* dividend of 5 per cent. per annum on the preference shares, amounting to £1,562, placing to reserve fund £3,000, and carrying forward £2,299.

Penarth Electric Lighting Co., Ltd.—The directors report that the accounts for the year 1911 show that the total expenditure on capital account was £41,798. The gross revenue was £4,254, an increase of £380, and the expenditure £3,111, leaving a balance of £1,143. After allowing for interest on loans and debenture stock the profit is £285. Deducting the debit balance of £49 brought forward, the amount at the credit of net revenue account is £236, and the directors recommend that £200 be placed to depreciation and £36 carried forward.

Prospectus.—*The New York Telephone Co.*—Messrs. Baring Bros. & Co., Ltd., have been inviting applications for the London part (£1,750,000) of an issue of £4,000,000 (20 million dollars) 4½ per cent. first and general mortgage bonds in this company at 97½ per cent., £250,000 is reserved for Amsterdam, and the remaining $10,000,000 for the U.S.A. The proceeds are to be applied to repayment of advances obtained for improvements and to the acquisition of additional property.

Continental. — Switzerland. — La Société Franco-Suisse pour l'Industrie Electrique, of Geneva, reports a net profit of £47,310 for the last financial year; a dividend of 4½ per cent. is being declared.

Victoria Falls and Transvaal Power Co., Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum, less income-tax, for the period from October 15th to December 31st, 1910.—*Financier.*

Felten & Guilleaume Co.

The report for 1911 of the Felten & Guilleaume, Carlswerk, A.G. of Mulheim, states that the transfer of the Frankfort dynamo works to the A.E.G. was completed by the beginning of that year. The settlement of this business and the collection of debts owing to the former Frankfort department and its foreign subsidiary companies were still in progress, although depreciation had been made to an extent corresponding with the sacrifices involved. It was intended to devote the funds thereby rendered available, in addition to extending and improving the equipment of the Carlswerk, to the acquisition of the mining and ironworks undertaking of J. Collart & Co., of Steinfort, which was to be developed into a steel-producing enterprise capable of supplying the company's requirements in the matter of semi-finished steel. The accounts show the following figures for the two years, although the results are not directly comparable owing to the disposal of the dynamo works :—

	1911.	1910.
Share capital	£2,750,000	£2,750,000
Loan capital	1,241,000	1,264,000
Gross profits (manufacturing and investments) ...	509,000	570,000
General expenses	108,000	202,000
Depreciation	92,000	113,000
Interest on loans	55,000	56,000
Net profits	192.000	122,000
Dividend	165,000	110,000
Dividend, per cent.	6	4

The report states that the turnover of the Carlswerk was larger in 1911 than in the previous year, and prices were somewhat better. During the year the wire rolling works were well employed, and all departments in the cable factory were uniformly and well occupied, whilst the rubber factory was favourable in general. The number of employés and workmen at the end of 1911 was 7,073, as compared with 6,883 at the close of 1910 ; and a satisfactory development of business has, so far, proceeded in the new financial year.

South Metropolitan Electric Tramways and Lighting Co., Ltd.

The directors' report for 1911 states that there was expended on capital account £4,206, making the total £505,743. The total revenue from all sources amounted to £59,223, compared with £55,579 for 1910; the expenses were £35,054, compared with £34,105 for 1910, and the net revenue was therefore £2,694 more than in 1910. After deducting all expenses chargeable to revenue, including payment to local authorities under agreements and interest upon the debenture stock of the company, and after charging profit and loss account with the sum of £3,000 provision for renewals, there remains a surplus of £13,939 plus £339 brought forward, making £14,278. Out of this the directors recommend a dividend at the rate of 6 per cent. per annum on the preference shares for the year requiring £10,174, depreciation and reserve fund £3,500, carrying forward £604.

The gross receipts derived from the working of the tramways and light railways amounted to £45,630, being an increase of £2,171, and the working expenses amounted to £24,097, being an increase of £305. The gross receipts from the electricity supply section of the undertaking (including the amount represented by the sale of energy to the tramways), amounted to £12,783, and the working expenses to £6,433. The receipts for 1911 exceeded the receipts for 1910 by £1,349, whilst the working expenses were £381 in excess of those for 1910.

The total number of units sold, including 194,797 supplied to the tramways, was 836,122, as compared with 748,710 in 1910. The units sold for lighting and power purposes were 641,325, an increase of 84,677 units, or 15 per cent., compared with 1910. The number of consumers was 1,855, as compared with 1,172, an increase of over 15 per cent.

The meeting was held on Tuesday, May 28th, at Electrical Federation offices, Kingsway, Mr. C. G. Tegetmeier presiding.

The Chairman, in moving the adoption of the above report, said the year's operations showed an improvement upon those of the previous year. The surplus upon the working of the combined undertaking had amounted to £22,939 as compared with £20,245 In 1909 the working surplus was £16,113, and, in 1908, £13,777. Although the progress of the company was not so rapid as they had hoped and anticipated, and they had a long way to go before they got an adequate return upon the capital they had expended yet they could find encouragement in the fact that the growth of the company's earning power was steady and continuous, and clearly indicated that they had a property of a distinctly improving character. Dealing first with the tramway undertaking, the traffic receipts showed an increase of £2,102, and they carried 7,478,000 passengers, as compared with 6,982,000 in the previous year. The greater portion of that increase was on the Penge section of the lines. The development of the district served by the Croydon and Sutton section made but comparatively slow progress. A considerable portion of the district was still open country and furnished very little intermediate traffic, and it was somewhat surprising that with the many natural advantages and attractions it possessed the district had not more rapidly developed for residential purposes. That development, however, would certainly come sooner or later and in the natural course of things they expected it to be facilitated by the efficient transit facilities that their tramways provided. They could feel fairly sure that any growth of the population of the district would be reflected in an increase in their traffic receipts. The working expenditure for the tramways showed an increase of £304, and it was satisfactory to find that the increase in receipts of £2,102 had been earned at this comparatively slight increase in expenses. On repairs and maintenance they had spent the considerable sum of £5,516 and in addition they had spent £1,249 on actual renewals, which had been charged to the renewals account. The whole of the undertaking had been maintained in a thoroughly efficient state. With regard to the electricity supply portion of the business they had again to record fair progress. They had a net increase of 183 in the number of consumers and an increase of £1.216 in the sale of current for private lighting. A large portion of that increase was from the supply to new houses, and as in the case of the tramways the growth of the revenue was dependent to a large extent upon the residential development of the districts they served. The promising feature of the company's future was that a considerable proportion of their extensive area of supply was almost untouched and furnished the possibility of very large expansion in the lighting business. The capital expenditure during the year amounted to £4,206, practically the whole of which was spent on the electricity supply section. The larger proportion of that expenditure, £2,763, was for the cost of laying new mains to serve newly built houses. Expenditure of that kind was in most cases immediately remunerative, and every fresh consumer on the line of mains made it increasingly so. Their experience was that, if electric light was available, it was exceptional for any other form of illuminant to be adopted in new houses, but although the economy and other advantages of the electric light were generally recognised, it was a more gradual process to secure consumers from houses where gas had already been installed. The working balance of the two sections amounted to £27,782, or £2,814 more than the preceding year. The sundry receipts and interest amounted to £909, an increase of £143. On the other side, administrative and general expenses showed an increase of £260, accounted for by increased insurance premiums. They had set aside £1,000 more than last year to the renewals fund. They proposed to place £1,000 more than last year to the reserve and depreciation fund. After paying a year's dividend on the 6 per cent. preference shares, they would carry forward £603, as compared with £338 last year. Practically the whole of the increased profit for the year was placed to their two reserve funds, which, with this year's additions, would amount to £17,030. He felt sure the shareholders would endorse the policy of the directors in strengthening the company's position and looking to the future instead of making a larger dividend distribution.

Mr. Emile Garcke seconded the motion, and the report was adopted.

Paris Metropolitan Railway.

The report for 1911 of the Compagnie du Chemin de Fer Métropolitain de Paris deals at some length with the works executed by the City of Paris, and by the company during the year, and also sets forth the works in preparation. A slight increase took place in the mileage in operation, and the average for the whole of the year was 43·77 miles. Including various receipts, the total revenue in 1911 amounted to £2,170,000, as compared with £1,798,000 in the preceding year, whilst the working expenses reached £911,000 as against £772,000. The ratio of working expenses to the receipts was 42 01 per cent., as contrasted with 42·11 per cent. in 1910 and 42·83 per cent. in 1909. After deducting the share of the City of Paris—£712,000, as against £580,000 in 1910—and providing for the payment of interest on loans and other charges, the accounts exhibit net profits of £342,000, as compared with £296,000 in the previous year. A dividend has been declared at the rate of 16s. 9d. per share on an ordinary share capital of £3,000,000, this rate contrasting with 16s. per share in 1910. It appears that the average receipts per mile showed an increase over the previous year, when the traffic was seriously interrupted for a short time in consequence of the inundations in January, but the average was less than in the year 1909. The company's claim against the City of Paris in respect of the damage caused by the floods has not yet been settled. The number of employés and agents of all grades was 5,262 on December 31st, 1911, as compared with 5,023 at the close of 1910, whilst the amount of the bonuses paid in order to induce the men to take an interest in the good working of the railway, rose from £25,000 in 1910, to £33,000 last year. The passenger tickets issued during the year totalled 305,311,995.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Consolidated Gas, Electric Light and Power Co., of Baltimore—$700,000 additional common stock, in shares of $100 each.

Shawinigan Water and Power Co.—Further issue of $1,000,000 capital stock in shares of $100 each

And to allow the following securities to be quoted in the Official List—

Aron Electricity Meter, Ltd.—£100,000 5 per cent. first mortgage convertible debentures of £100 each, Nos. 1 to 1,000.

Cuban Telephone Co.—£155,000 additional 5 per cent. first mortgage convertible bonds.

Shawinigan Water and Power Co.—Further issue of £205,480 4½ per cent. perpetual consolidated mortgage debenture stock.

Doulton & Co., Ltd.—A financial daily states that the accounts for 1911, after providing for debenture interest, and £706 for depreciation of investments, and writing £500 off goodwill, show a debit balance at revenue account of £9,782.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	May 22	2,955	+ 158	51	74,293	+ 3,495	14·4	..
Ayr	„ 25	426	+ 60	2	426	— 70	8	..
†Bath	„ 15	881	— 286	20	14,751	+ 164	14·75	..
Birkenhead	„ 26	2,205	— 49	8	8,659	— 535	13·6*	..
Birmingham Corp.	„ 18	20,814	+6,585	7	71,822	+19,721	57·17	..
Blackburn	„ 22	2,357	— 16	8½	9,629	— 156	14·62	..
Blackpool Corp.	„ 23	1,298	+ 6	..	6,595	— 49	11·87	..
Blackpool-Fleetw'd	„ 25	885	— 19	20	7,513	+ 149	8	..
Bournemouth	„ 22	3,389	+ 116	7⅔	13,885	+ 587	21·95	..
Bradford	„ 19	10,575	+ 101	7	38,549	— 574	56	1·2
Brighton	„ 26	1,974	— 106	8	7,758	— 281	9·5	..
Bristol	„ 24	13,785	+1,101	..	182,474	+11,881	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	„ 17	580	+ 141	20	5,605	+ 1,406	3·65	..
Barnsley	„ 17	388	— 26	„	3,157	— 330	..	..
Barrow	„ 17	731	+ 187	„	6,542	+ 1,664	5·37	..
Devonport	„ 17	1,060	+ 121	„	10,293	+ 1,557	8·85	..
Gateshead	„ 17	2,061	+ 18	„	19,682	— 147	11·25	..
Gravesend	„ 17	419	+ 4	„	3,933	+ 224	6·5	..
Greenock	„ 17	1,610	+ 123	„	14,816	+ 2,098	7·25	..
Hartlepool	„ 17	542	+ 39	„	4,759	+ 354	6·72	..
Kidderminster	„ 17	191	— 17	„	1,834	+ 88	..	..
‡Leamington	„ 17	284	+ 28	„	2,980	+ 183	..	..
Merthyr	„ 17	331	— 52	„	3,492	— 352	2·9	..
Metropolitan	„ 17	17,852	— 184	„	168,676	+ 9,198	22	..
Middleton	„ 17	706	+ 24	„	6,013	+ 43	8·5	..
Mid. Joint Com'tee	„ 17	6,217	+ 142	„	60,224	+ 2,092	..	..
Oldham—Ashton	„ 17	1,243	+ 96	„	11,516	+ 784	9·13	..
Peterborough	„ 17	253	+ 25	„	2,306	+ 205	5·31	..
Potteries	„ 17	3,899	+ 37	„	35,156	— 2,442	29	..
Rothesay	„ 17	235	— 17	„	1,619	+ 94	2·75	..
Southport	„ 17	585	— 48	„	5,078	+ 77	8·17	..
S. Metropolitan	„ 17	1,712	— 153	„	15,529	+ 680	..	..
Swansea	„ 17	2,140	— 19	„	21,213	+ 206	13·5	..
Tynemouth	„ 17	404	— 6	„	3,275	+ 2	3·75	..
Weston-s-Mare	„ 17	173	— 43	„	876	— 32	3	..
‡Worcester	„ 17	576	— 27	„	5,010	+ 28	5·75	..
Wrexham	„ 17	216	+ 20	„	2,069	+ 226	..	..
Yorks. Wool. Dist.	„ 17	2,157	+ 30	„	20,446	+ 598	17	..
Miscellaneous	„ 17	452	— 12	„	4,140	+ 141	..	..
Burnley	„ 25	2,875	+ 131	..	..	..	11·73	..
Burton-on-Trent	„ 26	548	+ 22	8	1,941	+ 14	6·6	..
Bury	„ 26	2,595	+ 39	8	10,706	+ 122	23·5	..
Cardiff	„ 18	4,580	— 121	7	14,267	— 2,421	17·35	..
Chatham and Dist.	„ 28	1,686	+ 29	21	16,548	+ 290	14·98	..
Cork	„ 28	1,021	— 118	21	9,496	— 39	9·89	..
Croydon	„ 17	3,635	— 6	7	12,616	+ 40	11·6	·75
†Darlington	„ 18	225	+ 21	..	1,449	+ 6	4·87	..
†Darwen	„ 17	227	+ 6	7	1,897	+ 45	4·36	..
†Dover	„ 18	214	+ 7	7	1,548	— 69	4·75	..
Dublin	„ 24	11,907	+ 391	..	115,2·5	+ 7,548	54·75	..
East Ham	„ 25	2,188	+ 48	8	8,480	+ 245	7·87	..
Exeter	„ 24	6·7	— 49	8	2,436	— 171	5·5	..
Glasgow	„ 25	39,259	—1,712	..	971,886	+43,453	98	·25
Hastings	„ 28	1,777	— 120	..	..	— 572	19·8	..
†Huddersfield	„ 18	2,024	+ 209	7	13,348	— 263	29·5	1
Hull	„ 25	5,699	+ 293	8	22,935	— 667	13·5	1
Ilkeston	„ 9	191	— 58	6	855	— 427	..	..
†Ipswich	„ 18	394	+ 22	7	2,878	+ 78	10·5	..
Kilmarnock	„ 18	364	— 4	..	..	..	4·25	..
Lancashire United	„ 21	2,795	+ 44	21	25,766	— 441	89	..
†Leeds	„ 18	7,850	+ 595	7	52,665	+ 1,509	112·7	..
Leicester	..	..	..	..	..	..	20	..
Leith	„ 25	1,389	+ 75	1⅔	1,007	+ 33	8·72	..
†Liverpool	„ 18	11,926	+ 402	19½	280,911	+11,080	116	..
‡L.C.C.	„ 15	88,151	— 856	..	281,558	— 1,284	140·5	2
London United	„ 25	18,309	— 454	21	123,678	+ 870	..	..
Lowestoft	„ 25	277	— 42	24	5,190	— 129	3·5	..
Manchester	„ 25	33,788	+1,042	7	115 378	+ 5,599	105	..
†Newcastle	„ 18	4.290	+ 322	..	28,760	— 850	31·3	..
Newport	„ 18	1,244	— 61	7	4 468	— 632	7·25	..
†Oldham	„ 19	2,049	+ 31	8	16,406	+ 233	23	..
†Pontypridd	„ 18	383	— 23	7	2,359	— 709	5·5	..
†Portsmouth	„ 11	1,977	— 136	6	12,425	+ 124	15·75	..
Preston	„ 22	1,552	+ 38	8	6,192	+ 184	10	..
Rotherham	„ 22	1,414	+ 76	7⅔	4,908	— 176	12	..
Salford	„ 20	10,031	+ 441	7	35,486	+ 983	41	..
†Sheffield	„ 21	6,783	+ 373	8	49,469	— 148	40	..
Southampton	„ 22	2,362	+ 134	7	8,980	+ 605	11	..
Southend-on-Sea	„ 15	1,298	+ 199	7	4,899	+ 707	7	..
†South Shields	„ 18	615	+ 40	7	3,978	— 131	10·25	..
Tyneside	„ 22	967	+ 36	21	2,253	+ 503	11	..
Wallasey	„ 25	2,100	— 79	7⅔	8,416	— 362	6·72	..
Walthamstow	„ 25	1,559	+ 86	8	6,152	+ 257	9	..
West Ham	„ 16	5,484	+ 103	6⅔	17,989	+ 299	16·4	..
†Wolverhampton	„ 22	974	+ 34	8	7,233	+ 65	13·75	1
Cen. London Rly.	„ 25	8,571	—1,437	21	98,008	—11,660	6·32	..
City & S. Lon. Rly.	„ 26	5 906	— 210	21	66,689	— 4,897	7·26	..
Dublin-Lucan Rly.	„ 24	303	+ 12	21	2,669	+ 67	7	..
G.N. and City Rly.	„ 25	3,145	+ 266	21	34,598	+ 2,064	3·5	..
†L'pool Overh'd Rly.	„ 19	1,609	+ 126	..	30,036	+ 1,876	6·6	..
†Llandudno-Col. Bay	„ 17	209	+ 10	24⅔	3,915	+ 229	6·5	..
Lond. Elec. Ry. Co.	„ 25	26,910	+ 135	21	297,810	+ 3,625	21·25	..
Mersey Railway	„ 25	4,181	+ 164	21	43,402	+ 6	4·5	..
Metropolitan Rly.	„ 26	33,6 0	— 217	21	345,496	— 9,977	25·75	..
Met. District Rly.	„ 25	24,847	+1,094	21	262,588	+10,699	25	..
†Anglo-Argentine	„ 20	50,345	+2,342	..	1,031,603	+89 673	..	..
§Auckland	April 5	17,472	+1,088	..	172,044	+18,495	23·3	..
Bombay (B.E.T.)	„ 25	6,285	+ 594	17	51,425	+ 3,197	..	..
§Brisbane	..	..	..	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	May 25	7,964	+ 12	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	April	3,084	..	4	12,036	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	April 30	1,708	+ 144	..	13 067	+ 1,157	13·5	·75
§Montevideo	April	28 0·4	+2 778	6	185,361	+19,185	..	..
†Perth (W.A.)	May 17	1,935	+ 391	..	67,802	+ 5,867	29	..

* Compared with the corresponding period of 1911. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

THE Stock Exchange returned from its holiday without much bullish enthusiasm. Markets had gone against holders so badly last week that apprehension of a difficult settlement on Friday next, May 31st, was rife. The strike of transport workers aroused alarm lest the trouble should spread to the railways, and Home Railway stocks have been extremely flat.

Severe liquidation in Metropolitan Consolidated caused the price to drop abruptly to 62 at one time, from which there was a smart rally, though the recovery was not fully maintained, and on the week the price is 5¾ lower at 62½. A statement is in circulation to the effect that the Speyer group will take over the Metropolitan Company on the basis of a 3½ per cent. dividend on the Consolidated stock, and if this should be correct, Metropolitans ought to stand in the neighbourhood of 70—that is to say, yielding a return of 5 per cent. on the money. Nothing, however, has been announced officially, and it will be remembered that quite recently a denial was forthcoming from the Speyer group as to certain negotiations being in course whereby 4 per cent. would be guaranteed to the Ordinary stockholders. City and South London has been extremely flat, and the stock, after its drop to 33½, begins to look somewhat attractive. Districts are down 3. Central Londons broke away, and East Londons crumbled to 7⅞; while, amongst the steam electricity stocks, Brighton Deferred has been hammered down below par.

Underground Electric Ordinary fell back 7s. 6d., the 1s. "A" shares maintaining a certain amount of steadiness at 15s. middle. The company's Income Bonds shed 2. Market nervousness, aroused at first by the magnitude of the bull account, was naturally accentuated by the threatening outlook in the labour world, but there are shrewd observers who think the slump in prices has gone far enough already.

Electricity Supply shares are easier as regards City of Londons, where the Ordinary and Preference both fell ¼ upon further realisations by some of the staler bulls. London Electrics are also down, the price falling ⅛ to 1⅛ middle. This may be due to a possible line of shares hanging over the market, and in spite of the greater demand that has recently arisen for most of the Supply Companies' shares, to deal in a thousand or so is not always easy. Counties are steady at 10⅞ middle, and there is no movement in Charing Cross.

Of the Latin-Canadian varieties, the big jump in Sao Paulo Trams of 13 points last week has been followed by a fresh rise of 7, which has brought the price up to 244½, with anticipation making certain of an increase in the dividend before long. Rio Trams, after showing a certain amount of weakness, spurted to-day (Tuesday), and buyers gave up to 138 for the shares. On balance, the quotation shows an advance of 3 to 137. The very substantial advance in Mexican Light and Power Common brought in a few profit-takers, with the result that the price has slipped back a couple of points. But Mexican things as a whole are steady, and the market is firm enough. Bonds in this section are still in considerable demand. An issue which will be made in the course of possibly the next few days, is one of $4,000,000 first mortgage 5 per cent. gold bonds at 90 in the Consolidated Cities Light, Power and Traction Company. With the bonds, $800,000 Common stock is offered at $30. Advance subscriptions are being secured now, preparatory to a public issue very soon, the early birds of course getting a cash consideration as well as a little extra through the issue of Common shares. Shawinigan Water went back 2 after its substantial improvement, but the other Latin-Canadian issues have held their rises well.

The Telegraph market finds its chief excitement in the mercurial movements of Marconis. This time last week the price was 6⅛; it has been down to 4⅞, and is now up again to 5⅝. American Marconis have kept an eighth or so under 2, and are not likely to make much headway on this side of the special settlement. Canadian Marconis at 24s. are a couple of shillings above the lowest, the market in all these shares being very timid, and responsive to comparatively small lines of shares purchased or sold.

West India and Panama shares are still dull. Great Northerns fell 25s. Anglo-American Telegraph Preferred gained a further ¼. West Coast of Americas have fallen a similar amount. Dealings in National Telephone Deferred stock have been mainly on account of speculators who wanted to get out, though when these sales were absorbed, the market rallied, and the price is 2½ down on the week.

The Manufacturing group is so steady as to be almost negligible. British Insulated Ordinary rose 5s., and Babcock Preference are a trifle better. Except for these, there are no quotable changes to record.

Ruston, Proctor & Co., Ltd.—After paying preference dividend, and 8 per cent. per annum on the ordinary shares, £25,000 is transferred to reserve and equalisation of dividends account, and £14,930 is carried forward.

Lima Light, Power and Tramways Co., Ltd.—The directors announce a dividend of 1½ per cent. for the quarter ended March 31st.

Mackay Companies.—The directors have declared the regular quarterly dividend of 1¼ per cent. on the common shares.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations May 28th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	* 10	5½	5½	9¼ — 10¼	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	4 12 2
Do. Second 6 % Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	100 —102	..	4 8 8
Brompton & Kensington, Ord.	5	10	10†	8¼ — 8¾	..	5 14 3
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 8⅛	..	4 6 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	99 —102	+1	3 18 5
Charing Cross, West End & City	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8¾ — 4½	..	5 2 10
Do. Do. % Deb.	100	4	4	95 — 98	..	4 1 8
Chelsea, Ord.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	8	20 — 22	— ½	3 12 9
Do. 6 % Cum. Pref.	10	6	6	16½ — 18½	— ½	3 4 10
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 6 7
County of London, Ord.	10	5	6	10⅝ — 11⅛	..	5 7 10
Do. 6 % Pref.	10	6	6	11¼ — 11⅝	..	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅛ — ¼	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 — 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	6	6	4⅜ — 4⅝	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 4⅞	..	5 5 3
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 13 9
Hove	5	9	9	6½ — 7	..	6 8 7

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations May 28th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Kensington & Knightsbridge, Ord	* 5	9	9	7¼ — 7⅜	..	5 16 2
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2⅜	1⅛ — 2	— 3/16	3 15 0
Do. 6 % Pref.	5	6	6	4¾ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	92 — 95	..	4 4 3
Metropolitan	5	5	4†	3⅝ — 4⅛	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	85 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96 — 98	..	4 11 10
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4½ — 5	..	5 0 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	97 —100	..	5 0 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10½ — 11½	..	5 6 8
Oxford	5	7½	7½	5⅞ — 6⅛	..	5 18 9
St. James' and Pall Mall, Ord.	5	10	10	8 — 8½	..	5 14 3
Do. 7 % Pref.	5	7	7	6¾ — 7⅛	..	4 15 0
Do. 3½ % Deb.	100	3½	3½	86 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	2	1⅝ — 1⅞	..	..
South London, Ord.	4	5	5	2¾ — 3¼	..	6 8 0
Do. 5 % First Mort. Deb.	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1⅛	..	6 1 0
Do. 4½ % First Deb. Stock	100	4½	4½	98 — 99	..	4 11 0
Urban, Ord.	5	5	..	⅞ — 1	..	..
Do. 5 % Cum. Pref.	5	5	..	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8½ — 9	..	5 11 1
Do. 4½ % Cum. Pref.	5	4½	4½	5⅛ — 5⅜	..	4 4 8

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅜ — 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	8½	7¼ — 7⅝ xd	..	5 9 8
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	95½ — 97⅝	+1	5 2 7
Canadian Gen. El. Com.	$100	7	7†	112 —116	..	6 0 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	3†	1⅜ — 1⅝	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	95½ — 97½	..	6 3 1
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	7/16 — 9/16	..	Nil
Do. 6 % Pref.	1	6	6	3⅛ — 3⅜	..	3 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 —105	..	4 15 3
Madras, Ord.	5	..	..	2¼ — 2⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	104 —107	+1½	4 13 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	87½ — 89½	..	5 11 9
Mexican Lt. & Power, Common	$100	4	4	89 — 91	—2	4 8 0
Do. 7 % Cum. Pref.	$100	7	7	104 —106	..	6 12 1
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96 — 98	..	5 2 0

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90	+ ½	5 11 1
Montreal, Lt., H. and Power	$100	7	8	211 —215	+2	3 14 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	39 — 41	..	12 8 10
River Plate, Ord.	Stock	10	10	240 —250 xd	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 —114 xd	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	103 —105	..	4 15 3
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	140 —144	—2	3 9 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108½—110½	..	4 10 6
Do. 4½ % Per. Deb.	Stock	4½	4½	102½—104½ xd	..	4 6 2
Toronto Power, 4½ % Deb.	Do.	4½	4½	100½—102½	..	4 7 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	99½ — 94½	..	5 5 10
Victoria Falls Power, Pref.	1	Nil	11¼d.	7/16 — 15/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½—107½	..	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7⅛ — 7⅝	..	..
Do. 5 % Deb. Red.	Stock	5	5	97½ — 99½	..	5 0 6
American Telep. & Teleg., Cap.	$100	8	8†	143 —150	— ½	5 6 8
Do. Collat. Trust	$1000	4	4	95 — 97	..	4 2 6
Anglo-American Telegraph	Stock	8½	8	65 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	108 —109	+ ½	5 10 1
Do. Def.	Do.	80/-	80/-	25⅜ — 25⅞	..	5 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	..	7⅜ — 8	..	4 10 4
Commercial Cable, Stg. 4 % Deb.	Stock	4	4	82½ — 84½	..	4 14 8
Cuba Telegraph	10	6	6†	9¼ — 10⅛ xd	..	5 14 3
Do. 10 % Pref.	10	10	10	16⅜ — 17⅛ xd	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7⅛ — 7⅞	— ⅛	6 9 0
Direct United States Cable	10	4½	5	7½ — 8	..	6 5 0
Direct W. India Cable, 4½ % Red. Deb.	100	4½	4½	99 —101	— ½	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	5†	135 —138	..	5 1 1
Do. 8½ % Pref. Stock	Do.	8½	8½	80 — 82	..	4 4 10
Do. 4 % Mort. Deb.	Do.	4	4	99½—101½	..	3 18 10
Eastern Extension	10	7	5†	12¾ — 13⅛	..	5 5 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97 —100	..	4 0 0
Globe Telegraph and Trust	10	5⅞	6†	10⅞ — 11⅜	..	5 5 6
Do. 6 % Pref.	10	6	6	13 — 13⅝	..	4 9 0
Great Northern Telegraph	10	18	18	28½ — 29½	—1½	6 1 0
Indo-European Telegraph	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common	$100	5	5†	87 — 90	..	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	69 — 72	..	5 11 1
Marconi's Wireless Telegraph	1	5	..	5⅜ — 5⅝	— ⅛	..
Do. 7 % Cum. Partic. Pref.	1	16	..	4¾ — 5	— ⅛	..

Monte Video Telephone, Ord.	1	6	6	1 — 1⅛	..	5 6 3
Do. 5 % Pref.	1	5	5	⅞ — 1	..	5 10 6
National Telephone, Pref.	Stock	6	6	100 —103	+ ½	..
Do. Def.	Do.	6	6	150½—152½	—2½	..
Do. 5 % Non-cum. 3rd Pref.	5	5	5	6 1/16 — 6 3/16	— 1/16	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101	..	4 7 2
Oriental Telep. and Elec.	1	8	8	1⅛ — 1⅜	..	4 18 0
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	89 — 91	..	4 8 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½—101½	..	3 18 10
Reuter's	8	5	5†	11 — 11½	..	3 9 7
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7⅜ — 7⅞	..	5 1 7
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 8 11
West Coast of America	2½	2½	2½	1¼ — 1½	— ½	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	94½ — 97½	..	4 2 1
West India and Panama Teleg.	10	1½	1½	2⅜ — 2⅞	— 1/16	4 7 0
Do. 6 % Cum. 1st Pref.	10	6	6	10¾ — 11	..	5 9 1
Do. 6 % Cum. 2nd Pref.	10	6	6	9½ — 10½	..	5 17 1
Do. 5 % Debs.	100	5	5	102½—104½	..	4 15 8
Western Telegraph, Ltd.	10	7	6†	15¾ — 18⅜	..	5 2 9
Do. 4 % Deb.	Stock	4	4	98 —100	..	4 0 0
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations May 28th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	7/32 — 11/32	..	Nil
Do. 5 % Pref.	1	5	5	1/16 — 1/8	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref.	100	..	..	10½ — 12½	— ½	..
Do. Do. Deferred	100	..	..	6⅜ — 8½	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	92 — 94	..	6 7 8
Do. 7 % Non-Cum. Pr'f.	100	..	..	44 — 48	..	..
Do. 5 % Perp. Deb.	100	5	5	94 — 97	..	5 3 1
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 83	..	5 8 5
Central London Railway, Ord.	100	3	3	77 — 79	—4	3 16 0
Do. Pref.	100	4	4	84 — 86	—2	4 13 0
Do. Def.	100	2	2	77 — 79	—4	2 10 8
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
City & South London, Ord.	100	1½	1⅝	33 — 34	—4	4 15 7
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 15 3
Do. Do. 1901	100	5	5	104 —106	..	4 14 4
Do. Do. 1908	100	5	5	103 —105	..	4 15 3
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10⅝ — 11⅛	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅛ — 1⅞	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	6	3/16 — 5/16	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼ — 2⅜	..	4 11 0
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	83 — 85	..	5 17 8
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	4⅜ — 5⅛	— ⅛	..
Do. 4 % Deb.	100	4	4	78 — 81	..	4 18 9
Metropolitan Railway Consol.	100	1⅜	1½	62½ — 62⅝	—5/8	2 19 9
Do. Surplus Lands	100	2⅜	2½	66 — 68	—1	4 4 7
Do. 3½ % Deb.	100	3½	3½	89 — 91	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	87 — 89	..	3 18 8
Metropolitan District Ord.	100	Nil	..	40 — 40½	—3	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	99 —101	+1	3 19 3
Do. 4½ % First Pref.	100	3⅞	4½	90 — 92	..	4 17 10
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5½	6	1⅜ — 1	..	6 0 0
Do. Def.	1	Nil	..	1/16 — 1/8	..	Nil
Do. 5 % Pref.	1	5	5	3⅜ — 3⅝	..	5 10 6
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % Deb.	100	5	5	98 —100	..	5 0 0
Potteries, Ord.	1	2	..	5/16 — 7/16	— 1/16	..
Do. 5 % Pref.	1	5	5	3/16 — 5/16	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	87 — 90 xd	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	3/16 — 5/16	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 4 0
Underground Elec. Railways	10	..	..	3⅞ — 4	— 3/8	Nil
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	88 — 90	—2	..
Yorkshire (West Riding), Ord.	5	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	5	Nil	..	2⅛ — 3⅛	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½	5⅛ — 5⅜	..	5 0 0
Do. 2nd Pref.	5	5	6⅛	4 11/16 — 5 3/16	..	5 6 0
Do. 4 % Deb.	100	4	4	95 — 96½	..	4 2 11
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	104 —106	+1	4 14 4
Auckland Trams, 5 % Deb.	100	5	5	104 —106	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11⅛ — 11⅝	+ 1/8	5 3 3
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	99 —101	..	4 19 0
Brisbane Trams Invt., Ord.	5	8	8	9 — 9⅛	..	4 4 3
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	140 —144	..	5 11 1
Do. Pref. Ord.	100	6	6	125 —128	— ½	4 13 9
Do. 5 % Pref.	100	5	5	111 —114	..	4 7 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98½ —101½	..	4 8 8
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	104 —106	..	4 5 0
Calcutta Trams, Ord.	5	6	7	6⅛ — 6⅜	..	5 5 8
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
Cape Electric Trams	1	Nil	2½†	2/16 — 3/16	..	..
City Buenos Aires Trams (1904)	5	5	5	5 3/16 — 5 5/16	..	4 10 6
Do. 4 % Deb.	100	5	5	101 —103	..	4 17 3
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101 —104	..	4 16 2
Kalgoorlie Elec. Trams	1	Nil	..	1/16 — 3/16	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94	..	5 6 5
Do. 6 % B Deb.	100	5	6†	56 — 60	..	10 0 0
La Plata Elec. Trms, Ord.	1	..	..	1/16 — 3/16	..	..
Do. Pref.	1	6	6	3/8 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6	1 — 1⅛ xd	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Madras Elec. Tr. (1904), Deb.	100	5	5	100 —102	+1	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	93 — 96	..	5 4 2
Manila Elec. R. and Ltg., Bonds	$1000	5	5	102½ —104½	+ ½	4 15 8
Mexico Trams Com.	$100	7	7	121 —123	— ½	5 13 10
Do. Gen. Con. 5 % Bonds	..	5	5	96 — 98	..	5 2 0
Do. 6 % Bonds	100	6	6	103½ —105½	..	5 13 9
Para Elec. Rlys. & Lt., Ord.	5	10	10	7 — 7⅜	..	6 15 7
Do. 6 % Pref.	5	6	6	5 — 5⅛	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	100 —102 xd	..	4 18 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1⅛ — 1 5/16	..	1 18 4
Do. 5 % 1st Deb.	100	5	5	101 —104	..	4 16 2
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	99 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	136 —138	+3	3 12 6
Do. 1st Mort. 5 % Bonds	..	5	5	103⅜ —104¾	— ⅛	4 15 6
Do. 5 % Mort. Bonds	100	5	5	99 —100	+ ⅛	5 0 0
Sao Paulo Tram, Lt. and P.	$100	10	10†	242 —247	+7	4 1 0
Do. 5 % 1st Deb.	$500	5	5	105½ —107½	+ ½	4 13 0
Singapore Trams, 5 % Deb.	100	5	5	79 — 82	..	5 19 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	6	7	5½ — 6	..	6 1 11
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	100 —103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	103 —105	..	4 5 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	11/16 — 13/16	..	7 7 8
Do. 6 % Pref.	1	9	6	6⅝ — 6¾	..	7 2 2
Babcock & Wilcox	1	26	28	6⅜ — 6⅝	..	4 4 7
Do. Pref.	1	6	6	1⅜ — 1⅝	+1/16	3 18 10
B.I. & Helsby Cables	5	10	10	7 — 7⅛	+ ⅛	6 13 4
Do. Pref.	5	6	6	6 — 6⅜	..	4 12 4
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	91½ — 94½	..	4 15 3
British Westinghouse, Pref.	3	Nil	..	3/16 — 5/16	..	Nil
Do. Deb.	100	4	4	63 — 66	..	6 1 3
Do. 6 % Prior Lien	100	6	6	100 —103	+1	5 16 6
Browett, Lindley, Ord.	1	Nil	..	1/6 — 2/-	..	Nil
Do. Pref.	1	Nil	..	5/- — 6/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — 1/16	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	77⅛ — 82¼	..	6 1 3
Do. 4½ % Deb.	100	4½	4½	54 — 59	..	7 10 6
Do. 4½ % Second Deb.	100	4½	4½	37 — 42	..	10 14 4
Callender's Cable	5	15	10†	10⅜ — 11½ xd	..	6 10 5
Do. Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
Castner-Kellner	1	17½	20	3⅜ — 3⅝	..	5 6 8
Do. Deb.	100	4½	4½	105 —109	..	4 10 7
Crompton & Co.	3	Nil	Nil	1/16 — 3/16	..	Nil
Do. Deb.	100	5	5	58 — 63	..	7 7 1
Dick, Kerr	1	5	..	3/16 — 3/16	..	5 3 1
Do. Pref.	1	6	6	1/16 — 1 1/16	..	5 12 11
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	..	1/16 — 3/16	..	Nil
Do. fully paid	5	Nil	..	1⅛ — 2⅜	..	Nil
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Do. 5 % Second Deb.	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	Nil	2½†	3/16 — 1	..	..
Do. Pref.	2	7	7	1⅞ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7⅞ — 8¼	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9⅜	..	5 5 3
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11⅜ — 12⅛	..	6 0 0
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 6 9
Do. Deb.	100	4½	4½	103 —105	..	4 5 9
India-Rubber, G. & T.	10	10	..	8½ — 9½	..	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	20	10†	34 — 36	..	6 13 4
Do. Deb.	100	4	4	99½ —101½	..	4 9 0
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	3/8 — 1	..	Nil
Do. Deb.	100	4	4	59 — 61	..	6 11 2

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING APRIL, 1912.

ALTHOUGH not so imposing at first sight as the previous month's figures, the April exports of electrical material reached the satisfactory level of £403,328, or excluding telegraphic business, £374,765, which was somewhat better than the figure for March, when the total of the exports reached £821,976, but included practically £450,000 worth of telegraphic business.

The feature of the export section is the £93,000 worth of cable exported, a third of the amount going to Japan, but the machinery sections, which reached approximately £150,000, were also at a satisfactory level.

The imports for the month amounted to £198,038, showing a considerable falling off as compared with March, when the total was £248,651. The re-exports at £28,504 were an improvement on the £23,374 recorded in the previous month.

Our best customer during the month was Japan, while attention may also be drawn to India, Canada and our Australian markets.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	700	948	35	200	186	300	14,550	3,730	83	...	...	607	21,339
Germany	781	1,418	13	115	660	2	1,220	...	8	29	13	151	4,410
Netherlands, Java and Dutch Indies ...	404	734	125	25	12	304	304	56	25	...	21	296	2,306
Belgium	411	454	95	...	394	22	3,724	667	7	313	786	4	6,877
France	1,256	270	1,173	...	40	6	6,336	1,386	22	150	242	657	11,538
Portugal	63	140	11	30	...	...	95	...	11	...	174	...	524
Spain, Canary Isles and Spanish N. Africa...	1,001	718	66	...	53	709	5,976	842	16	...	27	69	9,477
Switzerland, Italy and Austria-Hungary ...	581	99	3	30	377	933	1,531	1,712	20	...	119	686	6,091
Greece, Roumania and Turkey	103	...	55	10	...	25	271	13	24	...	3	220	724
Channel Isles, Gibraltar, Malta and Cyprus...	26	140	27	56	...	27	92	...	17	...	46	817	1,248
U.S.A., Philippines and Cuba	228	...	91	598	...	...	1,281	171	...	8	...	4,694	7,071
Canada and Newfoundland	154	304	517	3,220	...	2,568	9,403	690	266	46	299	12,282	29,749
British West Indies and British Guiana ...	349	...	14	223	...	105	137	...	49	...	...	...	877
Mexico and Central America	287	511	...	56	...	...	100	...	11	...	...	...	965
Peru and Uruguay	128	499	10	121	...	...	749	...	...	5	...	35	1,542
Chile	212	901	158	77	...	112	1,907	349	55	...	250	18	4,039
Brazil	964	733	60	280	48	215	5,885	2,287	88	23	115	395	11,093
Argentina	1,120	6,870	648	1,264	1,395	572	4,494	2,619	426	505	990	1,117	22,020
Colombia, Venezuela and Bolivia	35	59	36	14	...	...	611	...	61	...	51	...	867
Egypt, N. Africa and Persia...	432	...	105	127	25	20	725	...	212	...	296	1,048	2,990
British West Africa	52	855	147	35	...	23	2,417	5	169	...	38	84	3,825
Rhodesia, O.R.C. and Transvaal	7,788	552	1,776	2,133	15	120	6,716	458	1,599	...	94	357	21,608
Cape of Good Hope	1,383	1,537	113	698	45	851	3,059	119	3,169	103	94	915	12,086
Natal	1,672	2,617	1,744	315	10	65	1,772	...	164	137	18	...	8,514
Zanzibar, Brit. E. Africa, Mauritius & Aden	77	107	6	229	14	...	198	6	...	...	38	82	757
Azores, Madeira and Portuguese Africa ...	108	250	178	94	...	41	1,369	137	27	...	...	...	2,204
French African Colonies and Madagascar ...	...	...	...	...	...	...	...	10	...	...	...	22	32
China and Siam	224	539	188	149	10	262	713	39	46	44	50	157	2,421
Japan and Korea	1,281	31,913	290	...	37	2,799	15,048	215	51	...	12,469	...	64,103
India	3,362	19,545	1,781	2,106	197	593	6,958	1,732	2,264	277	1,657	254	40,726
Ceylon	143	313	303	95	109	31	530	67	765	...	34	54	2,444
Straits Settlements and Fed. Malay States	102	679	382	...	...	339	469	392	4,158	...	107	231	6,859
Hong Kong	140	239	118	...	...	23	152	56	30	...	82	318	1,158
West Australia	297	220	4	94	...	128	197	69	19	...	29	210	1,267
South Australia	301	208	313	365	...	...	1,249	444	45	...	3,995	25	6,945
Victoria	2,602	7,617	792	1,726	...	265	3,107	292	4,875	...	3,178	385	24,839
New South Wales	3,380	8,154	546	884	...	350	12,278	2,194	298	16	3,532	819	32,451
Queensland	649	...	30	22	...	247	2,859	56	5	51	684	...	4,603
Tasmania	...	...	8	...	...	...	32	...	...	...	...	967	1,007
New Zealand and Fiji Islands	940	3,426	378	1,044	44	239	11,324	283	674	...	2,793	587	21,732
Total, £	33,731	93,569	12,339	16,435	3,671	12,296	129,838	21,096	19,759	1,707	32,324	28,563	403,328

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	488	8	...	102	...	30	2,965	...	644	...	6,693	10,930
Germany	2,575	23,972	810	27,736	7,273	794	36,956	15,728	3,486	5,133	3,425	127,888
Holland	...	96	...	1,468	384	20	4	200	...	39	...	2,211
Belgium	399	1,735	202	...	16	274	2,783	...	191	1,130	5,978	12,708
France	...	...	766	1,814	327	547	815	222	1,693	3,558	2,278	12,020
Switzerland	58	419	114	44	36	41	22	1,822	...	19	22	2,597
Italy	34	4,713	...	...	...	...	551	...	...	...	4	5,302
Austria-Hungary	22	1,103	...	641	315	...	43	...	35	577	...	2,736
United States	2,103	141	1,553	414	2,021	...	7,362	6,360	320	399	548	21,221
Total, £	5,679	32,187	3,445	32,219	10,372	1,706	51,501	24,332	6,369	10,855	18,948	197,613

Additional imports: Spain, carbons, £230; Canada, goods, £185, electrical machinery, £10.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	2,846	705	...	2,014	1,104	...	4,207	...	190	701	16,737

TOTAL EXPORTS: £403,328. TOTAL RE-EXPORTS: £28,504. TOTAL IMPORTS: £198,038.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

REVIEWS.

Electric Railway Engineering. By C. F. HARDING. 1911. London: Hill Publishing Co., Ltd. Price 12s. 6d. net.

This volume, which the preface states is planned primarily for a senior elective course in a technical university, is written by Prof. Harding, of Purdue University, and covers the whole range of electric railway engineering in an elementary way. It makes no pretence of describing in detail any of the various sections falling naturally under its title; in fact, certain sections are so superficially treated that one wonders if it would not have been better to have left them out entirely. The volume is divided into four main sections: Part No. I is designated "Principles of Train Operation"; Part No. II, "Power Generation and Distribution"; Part No. III, "Equipment"; and, finally, Part No. IV, "Types of Systems." The two chapters on Traffic Studies, "predetermined" and "existing," are interesting, and the methods described of estimating the number of passengers likely to be carried over each route are worthy of a careful study. The fallacy of predicting the population for any considerable term of years by any rate of growth which has existed in the past, if the law of "yearly decrease in the rate of increase" be neglected, is pointed out, and diagrams based on the law for the Cities of Philadelphia, London, Paris, and New York, are given.

Chapter V confines itself to "Motor Characteristics," the superiority of the series motor for traction purposes being indicated in a clear manner. Why should the "Hopkinson" method of testing motors be called the "Pumping-back method?" It is almost universally known under the former name, and surely the profession's debt of gratitude to the founder of dynamo design demands its continuance.

Speed-time curves are lucidly explained in Chapters VI and VII, the method of calculating the rotative inertia of wheels and armatures being set forth at some length. Concrete examples of speed and distance, current and power curves are given in Chapter IX, this chapter being one of the best in the volume.

Dealing now with Part II and Chapter II—why call a "section insulator" a "circuit-breaker?" The former name clearly indicates its use, viz., an insulator between sections of the line; moreover, the latter is just as explicit, viz., an apparatus for interrupting the circuit where it is required. These are the generally accepted interpretations of the terms, and any alteration will, it is more than likely, lead to confusion. The statement that the two trolley wires are electrically connected at every hanger surely is incorrect; in this country they are only connected at each end of the section, so that to isolate one line, or cut it out in case of a ground, it is only necessary to pull out the switches in feeder or section boxes, the service then being maintained over the second wire. The system of feeding a single-phase railway from a three-phase machine, by connecting each phase to separate insulated sections of the line, does not appear to be good practice. If three-phase machines are already installed, the Scott three-phase two-phase connections are preferable, assuming the use of transformers, and if not, it is better to use only two phases of the alternator with reduced output.

In Chapter III "Sub-station Location and Design" is discussed at some length. Although it is perhaps true to a certain extent, that of late years the motor-generator has proved somewhat of a rival to a rotary converter, practice appears to be reverting to the rotary converter. This is as it should be, since no anxiety need be felt regarding hunting and commutation with turbine-driven generators and six-phase 25 or 50-cycle converters, provided the drop between synchronous machines is kept to moderate proportions. The statement that in *both* methods of starting rotaries—referring to starting from the D.C. side and with transformer taps—it is necessary to open the field in several places is, of course, incorrect. It should be pointed out that it is no longer necessary to couple two 600-volt converters in series for a 1,200-volt line, as 1,200-volt 25-cycle converters are now built with satisfactory operating characteristics.

"Power House Location and Design" is the title of Chapter V, and several of the remarks therein are reminiscen of earlier days; for instance, "the question of vibration and foundation construction should be given careful attention, especially where high-speed reciprocating plant is employed." Again, with regard to "diversity factor," this, it appears, has only recently been given proper attention by operating companies. Table XV, taken from Kent's "Mechanical Engineers' Handbook," and showing the comparative steam economy of turbines and compound engines, compares a 600-H.P. turbine with an 850-H.P. engine using saturated steam. Such a table is quite useless, and is liable to give a reader not familiar with the subject entirely erroneous ideas. Complete exception must be taken to the paragraph, "As a considerable amount of 125-volt direct-current power is used about the station for auxiliary control circuits, &c., the exciters should be considerably larger than the combined demand of all alternator fields which they are called upon to supply." It is absolutely essential that the excitation circuits should be free from interruption; in fact, it is now common practice to tie the exciters to the bars without circuit-breakers or fuses. To run auxiliary circuits from the exciter bars is simply inviting trouble, and cannot be too severely condemned. Under the heading "Switchboards" it is stated that "No protective device is installed between the generators and the bus-bars, although the outgoing transmission lines are protected with time-limit relays." This is pleasant reading, as a few years ago, after a plethora of papers on relays of all sorts and descriptions, the fashion was to install this apparatus at every available opportunity. It was quickly found, however, that the majority of the instruments were unreliable, and they were soon discarded.

In Chapter VII on "Electrolysis," the system of bonding in use in Chicago is shown. This consists of a double track with cross bonds and the inner rails connected by a 00 wire to a 500,000 circ. mil (say 0·4 sq. in.) bare copper longitudinal negative return cable. Provided the rail joints are efficiently bonded, it is difficult to see the use of this bare 500,000 circ. mil cable. Assuming that the rails weigh 100 lb. per yard, then four rails in parallel have an area of approximately 40 sq. in., and taking the ratio of resistivity of steel to copper as 10 to 1, the equivalent area equals 4 sq. in. of copper, so that the negative cable would carry back about 10 per cent. of the total current; hence, unless this cable is for some purpose other than stated, it appears to be of little use. No wonder Chicago is suffering from the effects of electrolysis when the city authorities allow a maximum rail drop of 25 volts.

Chapter VIII describes "Signal and Dispatching Systems" in a very clear way, but one is somewhat surprised to read that "the more complete systems have not been cast aside by the interurban railroads because of their unsatisfactory design and operating qualities, but rather because of their high first cost and maintenance charges."

In Chapter II, Part III, it is stated that steel-tired wheels are being superseded by cast steel on interurban roads, as difficulties were encountered due to the tires working loose in service. Unquestionably, one has heard of this trouble, but only in very rare cases, and then the cause is easily explained. All tires are usually bored out to a standard gauge, and should it happen that the centre has been re-tired several times previously, it will be found that its diameter has actually been reduced, so that the tire has too large a diameter, and, consequently, the tire becoming hot from the friction of the brake shoes works loose. It is good, sound practice to bore out each tire for the centre it is to be shrunk on.

Surely it is an error to state that the field coils are wound with *rubber* or asbestos-covered wire. While commutating poles delete commutation as a limit to the output, it is doubtful if the maintenance costs are reduced in tramway motors. Many engineers who have had experience with both classes of motors for tramway service are not at all enamoured with the commutating-pole machine, on account of its inaccessibility and consequent increase of time required for examination, and the multiplication of coils liable to breakdown.

Part III, Chapter I, covers alternating *versus* direct-current traction, the bulk of the chapter being taken up by the discussion between Mr. Sprague and Mr. Storer before

the American Institute of Electrical Engineers, while the final chapter is devoted to "Electric Traction on Trunk Lines," and includes Mr. B. F. Wood's tables for cost of electrification and power-house operation and maintenance costs for the West Jersey and Seashore Railroad, complete details of which have been published in the *Proceedings* of the A.I.E.E.

Viewed from the standpoint of the technical student who wishes to gain a preliminary insight into electric railway engineering, the volume must be classed as a success. It will, however, only whet the student's appetite, for he will quickly discover that the subject has only been touched upon in a very superficial manner. Contrary to the usual rule in works of this description there are few errors, the more important being the following :—In fig. 13 the curve showing the higher efficiency should be named "Efficiency without gears," and the lower curve "Efficiency with gears." The numerator in the expression under Equation 19 should be 5,280. On page 70 a reference is made to fig. 99 ; it should be fig. 98. In fig. 48 the three-phase lines would be better named "Incoming A.C. lines." On page 140 an error is made in referring to Table XI in place of Table XIII. In the formula for finding the amount of injection water required per lb. of steam, W is given as equal to 1,150 ; W is the total amount of water required, and H equals the B.TH.U.'s per lb. of steam at exhaust. Fig. 78 has the generator marked "D.C. Railway Generator" ; it should be "A.C. Railway Generator." In discussing permanent way, it is stated that "a liberal use of concrete, steel, and sand, &c."—the word "steel" should read "stone." Under control systems, the New York Central locomotives are given as having three running steps on their controllers, the first with all motors in series, the second consisting of two groups in parallel-series, and finally all motors in series ; this, of course, is an error for all motors in parallel. The gear ratio in the concrete example on the rotative inertia of wheels and armatures is reversed. There are a few cases of mis-spelling, such as "man" for "main," "condesing" for "condensing," &c.

The book has a good index, is well illustrated, and is printed in clear type, and, what is most important, it is of a size easy to hold in the hand.—S.W.

The Application of Hyperbolic Functions to Electrical Engineering Problems. By A. E. Kennelly, M.A., D.Sc. London : The University of London Press. Price 6s. net.

In May and June last year, Dr. Kennelly delivered a series of lectures on this subject for the University of London, at the Institution of Electrical Engineers. These lectures were very well attended, but there was a generally-felt want, during their progress, of a text-book where further information concerning the remarkably powerful mathematical processes, so ably expounded by Dr. Kennelly, could be found. It will, therefore, be understood with what gratification the announcement, made at the conclusion of the course, was received, that Dr. Kennelly had generously decided to devote the portion of the fee he had received for coming to this country to deliver these lectures, which was not taken up in travelling expenses, to producing the lectures in book form. This book has now been published, and in our opinion is one of the most useful contributions to the more theoretical side of electrical engineering literature which has appeared in recent years.

The first chapter deals with hyperbolic angles and hyperbolic trigonometrical functions, and discusses the relationship which these functions bear to the ordinary circular functions.

In the second chapter the problems which arise in connection with the flow of steady currents in lines, having uniformly distributed conductor resistance and insulation conductance, are discussed. The simplicity of the hyperbolic method of treating these questions will appeal with special force to those readers who are acquainted with the other methods of arriving at the same results.

In the third chapter the method is discussed by which a uniform line conveying continuous current can be replaced, as far as those portions of the circuit external to itself are concerned, by three resistances arranged in the form of either a T or a π, where the resistances forming the arms of the T, or those forming the legs or "pillars" of the π, are equal to one another. The solution of the converse problem is also investigated. That is, having given three resistances arranged in either of these two ways, it is shown how to deduce the data of the uniform line to which these combinations of resistances would be equivalent.

The next chapter deals with "loaded" steady current lines, that is, lines of which the uniformity is broken by the introduction either of a number of resistances in series in the line, or of a number of leaks to earth along the line. It is shown how, having given such a circuit, to deduce the data of a uniform unloaded line which shall be equivalent to the loaded line under consideration.

So far the author has been dealing with continuous-current flow, and has only required to introduce real or uni-dimensional quantities into his mathematical expressions. The study of the flow of alternating currents, however, necessitates the consideration of complex quantities, and, accordingly, the fifth chapter is devoted to a discussion of such quantities. The author points out that all the results which he has obtained for the flow of continuous currents are immediately applicable to the alternating-current case, if for the uni-dimensional quantities used in the former investigations we substitute the appropriate two-dimensional quantities. The geometry of complex quantities, and their mathematical manipulation, are dealt with very fully.

In the sixth chapter the phenomena which are met with in a uniform line carrying alternating currents are discussed. The seventh chapter is devoted to a consideration of the transmission of alternating-current power, and the eighth chapter deals with the theory of telephone transmission.

In the ninth chapter the application of hyperbolic functions to telegraph problems is discussed, and in the final chapter the discharge of a condenser through an inductive circuit is briefly considered.

The book concludes with a series of appendices, in which are given various data and demonstrations which have been omitted from the text, a list of the symbols used in the book with their definitions, and a bibliography of the subject of hyperbolic functions. It is a great convenience to the reader to have the symbols thus collected for reference, and the bibliography is exceedingly useful to anyone wishing to pursue the matter further.

We have little criticism to offer on the book. We think, however, that many readers will experience some difficulty in reading it, owing to the omission of intermediate steps in much of the work. It is not very difficult for the reader with some small acquaintance with the subject to fill in the gaps, but as the book is certain to be used to a large extent by beginners in this branch of applied mathematics, we feel that the subject matter would be more easily assimilated if these steps were given. We also think it would be better if much of the matter in the appendices were inserted at the corresponding places in the text, instead of being relegated to the end of the book. In subsequent editions some alterations and amplifications may be made. The book as it stands is, however, of great use to all who take an interest in the higher branches of electrical engineering, and the thanks of the electrical profession are due to Dr. Kennelly for enabling his lectures to reach, in this manner, a wider, and doubtless no less appreciative audience, than that which listened to them last year at the Institution of Electrical Engineers.

Die Konstruktionen Elektrischer Maschinen. By W. Peineke. (Vol. 16 of *Elektrotechnik in Einzel-Darstellungen*). Brunswick : Fried. Vieweg & Sohn. Price M. 3 60 pf.

This volume deals with the details of the mechanical construction of D.C. and A.C. rotating machinery, and is intended to give students and young designers an insight into modern methods of design and the reasons for their adoption.

The book is of a descriptive character, with a certain amount of critical comparison of one design with another, but its chief value lies in the numerous clear diagrams, which, in many cases, successfully take the place of pages of print.

Want of room has led to the omission of practically all calculations connected with the mechanical strength of the various parts, so that very few data as to actual dimensions are included. This is much to be regretted, because it is just in this direction that inexperienced designers find most difficulty in obtaining reliable information, and so are often constrained to follow existing conventional designs blindly.

The various chapters are devoted to: Iron stampings, the stationary members of D.C. and A.C. generators and motors, including windings, the rotating parts of the same, collector rings, commutators and brush gear, bearings, spindles, bed-plates, the cooling of machines, and foundations.

High-speed machinery is not dealt with. The book gives some useful information on a subject which is only cursorily dealt with in the ordinary text-books, and in this way should form a valuable adjunct to the latter.

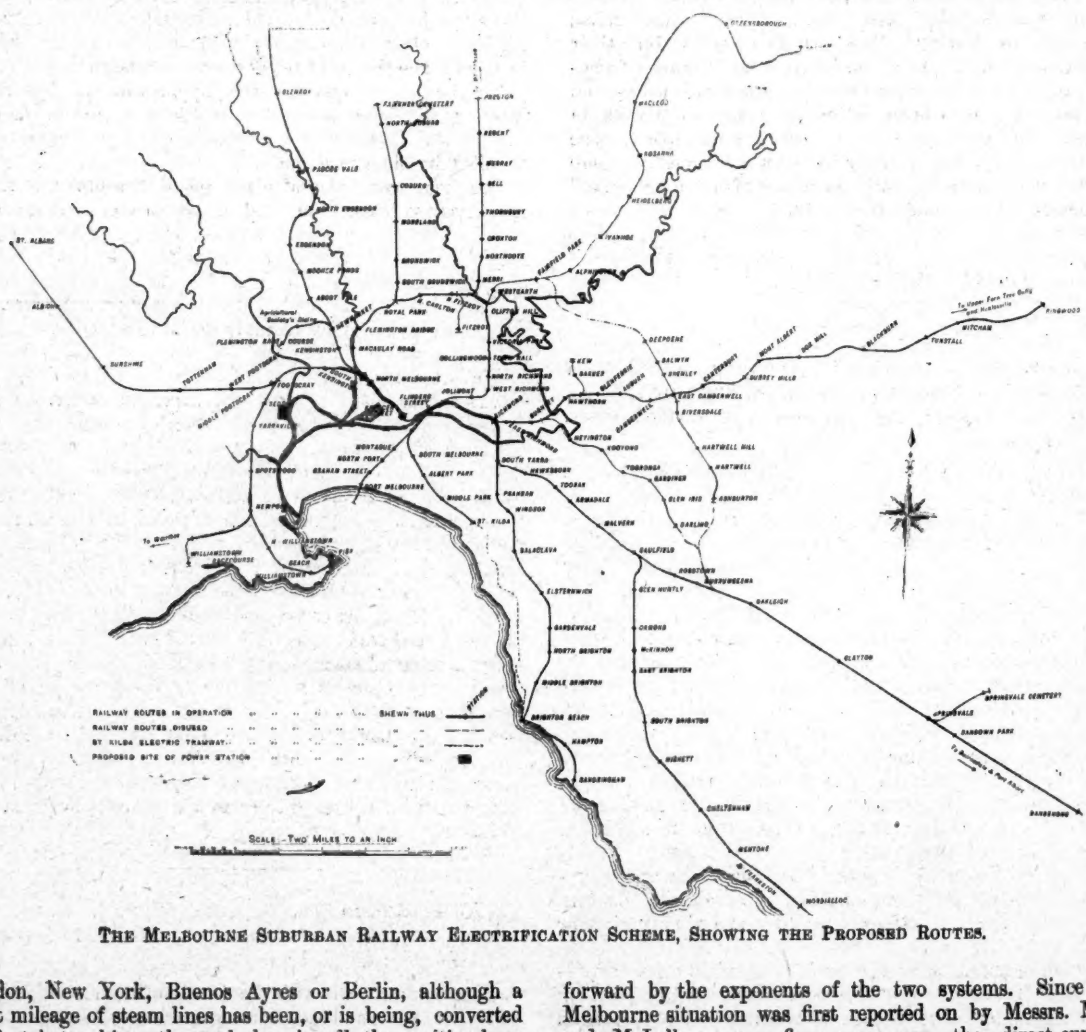
MELBOURNE SUBURBAN RAILWAY ELECTRIFICATION.

THE conversion of the Melbourne suburban railways to electric working will be one of the largest single projects of the kind yet carried out. In other great capitals, like London, New York, Buenos Ayres or Berlin, although a great mileage of steam lines has been, or is being, converted to electric working, the work has in all these cities been done more or less piecemeal. This is due, of course, to the fact that such a large number of different companies and authorities own the various transport systems, that there is no particular incentive towards electrifying at the same time, except in so far as mutual running powers might make it desirable.

In Melbourne, however, the lines being all in the hands of the State, practically speaking, only the consent of one authority is necessary; for although the State Railway Commissioners have very important powers, they are still the servants of the State, and cannot permanently resist public opinion, when sufficiently strongly expressed. This being so, a uniform and complete scheme is being prepared for Melbourne, involving the conversion of some 300 miles of track as a commencement. It will probably be extended to other lines as time goes on.

We publish herewith a map showing the lines to be converted, which also indicates the very complete nature of the Melbourne railways. As a matter of fact, even with steam, Melbourne possesses one of the best suburban services in the world. The absence of electric tramways (the tramways are cable operated) has made the suburban railway services the leading transportation agency in the Melbourne district, and the scattered nature of the suburbs has given the railways a further advantage as compared with the tramways.

Although the matter has been under consideration for many years, from one cause and another, political and economical, it has been deferred. Public opinion, however, has been steadily growing in favour of electric working, and the Government have decided that it is no longer necessary to allow the question of the choice of system to deter them from proceeding to carry out the work. They have adopted the wise course, however, of inviting tenders for both the direct and alternating-current systems, thus placing themselves in a position to decide on the best possible scheme put forward by the exponents of the two systems. Since the Melbourne situation was first reported on by Messrs. Merz and McLellan some five years ago, the direct-current system has been considerably developed, more especially in the direction of increase of pressure, and the economical radius to which it can now be extended is, of course, very much higher than formerly. On the other hand, the single-phase system since that day has been put into practical operation on a number of lines, and although no complete



THE MELBOURNE SUBURBAN RAILWAY ELECTRIFICATION SCHEME, SHOWING THE PROPOSED ROUTES.

data of working costs of any of the single-phase systems are yet available, the motor equipments are certainly better than they were, and the repairs and maintenance of them and the number of breakdowns have been considerably reduced. The overhead equipment and train equipment costs are still, however, higher than is desirable.

The magnitude of the present scheme will doubtless induce the big contracting firms to put forward their very best efforts in preparing proposals, and the decision of the Victorian Government is one that will be of first-class importance to the whole future of railway electrification. Moreover, the Government have very fully in mind the question of the extension of electrification in future to long-distance lines outside the suburban system, and they will not forget the fact in making their decision. The initial expenditure on the scheme is expected to reach between £2,000,000 and £3,000,000.

Mr. Charles Merz, M.Inst.C.E., sails for Melbourne shortly after the receipt of the tenders, in order to confer with the Government regarding the placing of contracts.

COMBINED IRRIGATION AND HYDRO-ELECTRIC POWER SCHEMES.

By E. KILBURN SCOTT, A.M.Inst.C.E., M.I.E.E.

Combined hydro-electric power and irrigation developments are becoming a very marked feature of electric enterprise in the United States. With the help of electric power whole areas of country have been and are being changed from almost arid deserts, to blossom forth with fruit farms and as wheat lands. About ten years ago, the writer drew the attention of readers of this paper to an experiment which had been made in California. Water was being pumped up from deep gravel beds by three-phase vertical spindle motors coupled to centrifugal pumps; the electric power for these was obtained from the hydro-electric power houses dotted about on the streams coming down from the mountains many miles inland. The experiment was a huge success, and large areas of Californian fruit land are now irrigated in this way. The writer has it from the geological experts that the stratification where deep water-bearing gravel beds underlie apparently waterless country is not peculiar to California. For example, it is met with in Australia and India, and some day this ingenious method of irrigation may be given a trial in those countries.

Another development which promises to be a much bigger thing, is the combination of hydro-electric power supply with an irrigation dam and pumping stations. In many parts of the British Empire, and particularly in Australia, it is possible to back up huge volumes of water by comparatively small dams. We have all seen what a tremendous change for the better has been brought about by the building of the Assouan dam, and that dam it should be noted is a large one, that is to say, it is not high, but it is very long and consequently expensive.

Now, wherever water is backed up to a considerable height, especially to say 100 ft. or more, for the purpose of conserving flood waters for irrigation, there also it is possible to develop electric power; not a great deal of power, as compared with some of the great natural water powers of the world, but still sufficient to make it worth while to build an electric power house as part of the dam structure.

In some cases the water thus backed up, can all be merely gravitated to the land which it is proposed to irrigate. In other cases the water is made to develop electric power, and this is transmitted to places on the river at a lower level, where pumping stations are placed to lift the water on to the adjoining land.

The Burren-Juck dam proposition in New South Wales is an example of the water being led to where it is wanted by gravitation; the main canals now being cut are nearly 100 miles long. But this dam is over 160 ft. high, and although no provision has as yet been made to harness its water-power, something will have to be done eventually. The thing is so obvious.

In the Argentine there is a combined irrigation and electric power proposition at work, and revenue is earned from both these sources. Irrigation is, of course, the primary function, and so the full water-power cannot be developed, but the engineer (an Englishman) has informed the writer that it amounts to about half the total power.

The amount of power which can be obtained from any given dam will, of course, depend on what provision is made for balance reservoirs lower down, into which the water can be passed when it is not wanted for irrigation.

Again, the question depends on the purposes for which the electric power is used. It is so easy to transmit electricity by overhead high-tension wires that the inexpert always think of electricity generated at a hydro-electric power house as being something to transmit a long way. But it does not follow at all. There are many electro-metallurgical operations which can be carried on just as well near the dam as 20 or more miles away. The manufacture of nitrogenous manure is an example, and in making this manure with irrigation water the former is being helped in two ways. It is commercially wise to use electric power as near to where it is generated as possible, also for any operations which can be temporarily suspended if need be. The supply of light and power to a city 50 or 100 miles away sounds well, but it is not necessarily wise or commercially advisable.

From time to time the writer receives information from the United States and elsewhere regarding hydro-electric and irrigation schemes. One such communication has just came to hand from Mr. Albert F. Cooke,* general manager of the Crane Falls Power and Irrigation Co., of Idaho. The consulting engineers are Messrs. Smith, Kerry & Chace, well known in the States for hydro-electric work:—

"This is the fourth hydro-electric power and irrigation development I have been on for my present firm. They seem to have a reputation that is hard to beat. My position here is that of general manager. We have a contract for five years to operate the irrigative system. The power plant is a low-head proposition, about 27 ft. effective head and the maximum water flow is about 10,000 cb. ft. per second. We are building the dam across the Snake River, at a place known as Crane Falls, Idaho. At present we will install three 3,000-K.V.A. units of plant, but the power house structure on the intake side is to be completed up to 18,000-K.V.A. capacity. The transmission lines will work at 66,000 volts.

"We have a considerable market for industrial power and lighting and some traction load, in addition to our irrigative load. The latter consists at present of two stations. The larger one has three lifts of 180 ft., 108 ft. and 70 ft. Worthington centrifugal pumps are being used, and the high-head pumps deliver 1,000,000 gallons per hour to the canals, and are driven by three 1,050-H.P. three-phase motors operated at 2,200 volts. There are seven pumps in all at this station, the other four being in proportion to the two lower lifts.

"The smaller station, some 15 miles further from the power plant, is fed by a 22,000-volt line from step-up transformers in the first plant. It has a capacity of 8,000,000 gallons per day, with 104-ft. lift."

In Australia it is of paramount importance to develop combined irrigation and electric power schemes. Along with a firm of civil engineers in Melbourne, the writer spent some considerable time working out the details and financial particulars of what came to be known as the Trawool scheme. Trawool is about 70 miles from Melbourne, and it was proposed to build a dam 180 ft. high and about half a mile long at the top, which would have impounded more water than there is in Sydney Harbour, or more water than is impounded by the present Assouan dam in Egypt.

At the present time much of the land which that water would have made to blossom as the rose, is either bush, or, where it is used, is only carrying about one sheep to the

* Brush men of about 17 years ago and others will remember Mr. A. F. Cooke. He went to Canada about 12 years ago, and passed from there to the United States, where his work has been mostly on hydro-electric installations.

acre. Naturally there is no population worth speaking of; in fact, although Australia is as big as Europe, there are fewer people in it than in London.

Every year floods of water pass over the site, and if the dam had been built, the water in passing from Trawool to a balance reservoir some miles lower down could have been made to develop quite a respectable amount of electric power. Some of it might have been transmitted to various mining and industrial centres such as Bendigo, Ballarat, and Melbourne, &c., but the chances are that most of it could have been profitably used in other ways. For example, in irrigating, by pumping, further areas that the gravitation canals could not reach.

The manufacture of nitrogenous manures by electric power naturally suggests itself, for although Australian soil can be very fruitful when it does receive water, much of it, as compared with soils in other places, carries little natural store of nitrogen. To intensely cultivate it, therefore, manure is required as well as water, and this is a point which some do not seem to appreciate.

When Mr. Merz prepared his report on the electrification of the Melbourne Railway system he was shown the figures, &c., and viewed the site. He was sufficiently impressed with the feasibility to mention it favourably in his report.

The scheme looked so promising that a syndicate was formed in 1906 to forward the proposal, but directly Trawool was mentioned in Parliament the party who always want Government to do everything said, "Why shouldn't we carry this out ourselves"? Their idea is that the Public Works Department should do everything.

To such an extent is it carried on, that the Architect's Department of the New South Wales Government has even prepared designs and quantities, &c., for such things as bathing sheds on the beaches, and shops for back streets.

Government employés seldom initiate any new scheme, but they are adepts at slightly altering schemes put forward by others and serving them up, years later, as their own.

One would naturally expect that the Government intended to do something, but they have not done it. The land that the Trawool dam could have irrigated still feeds a few sheep, and the floods still come down at intervals. Tweedledum and Tweedledee, paid politicians, still come and go and play the ridiculous old party game, spouting platitudes to the gallery.

There may be faults in the system of allowing private enterprise too free scope, but at any rate, things do get carried out; professional engineers and others, with brains, do get their chance; arid land is turned into fruit farms and wheat lands; the electrical manufacturers have plenty of orders; many openings are presented in construction work and management for engineers, and, incidentally, as we have seen in the Argentine and the United States, some of these are Englishmen.

IMPROVING THE LIGHT DISTRIBUTION FROM METALLIC-FILAMENT LAMPS.

USUALLY the filaments of metal lamps are arranged parallel to the vertical axis of the lamp, and, in lamps of medium or high C.P., in such manner as to form a cylindrical cage-work. As thus arranged, the lamp gives its maximum candle-power in a horizontal direction, and the illumination on a horizontal surface is approximately that given by the incident intensity $C = C_A \cdot \cos\theta$, where θ = angle to horizontal made by the incident beam.

This distribution of light is seldom suitable or efficient, so that various shades and reflectors are employed. The latter result in a more or less serious loss of light, and, with a view to obtaining a better natural downward distribution of light, M. Vodovosow has constructed lamps in which the filaments form the envelope of an inverted cone (see fig. 1). The bulb of the lamp is preferably ovoidal, but in all other respects the construction is quite normal.

The results of a comparison, by the Laboratoire Central d'Electricité, between the new type of lamp and one in which the filaments were arranged in the ordinary cylindrical manner, were as follows:—

	Lamp with filaments enveloping a cone.	Lamp with filaments enveloping a cylinder.
Terminal lamp voltage	102	110·5
Watts consumption	21·4	20·9
Horizontal intensity (bougies) ...	16	16
Mean spherical intensity „ ...	13·4	12·2
Lower M.H.-S. intensity (bougies) ...	15·4	12·6
Total luminous flux (lumens) ...	168	153
Ditto in lower hemisphere (lumens)...	97	79·2
Watts per horizontal bougie	1·34	1·31

These figures, and curves I and II respectively in fig. 2, clearly demonstrate the characteristic advantages of the conical lamp. The specific consumption per (lower) mean H.S. C.P. is 1·38 watts in the latter, as against 1·65 watts in the case of the ordinary drum-wound lamp. The 20 per cent. superiority of the conical lamp, on this basis, is of great practical importance. Apart from the disposition of the filaments, the downward concentration of light is materially aided by the large cap (fig. 1), which acts as a reflector.

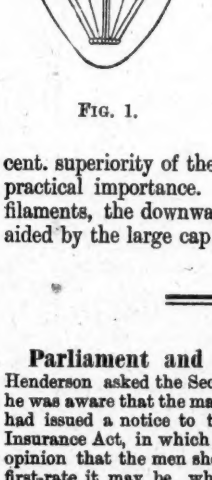
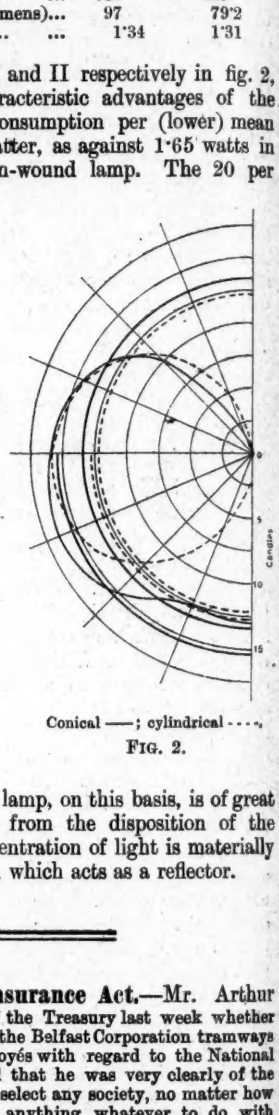


FIG. 1.



Conical ——; cylindrical - - - -.

FIG. 2.

Parliament and the Insurance Act.—Mr. Arthur Henderson asked the Secretary of the Treasury last week whether he was aware that the manager of the Belfast Corporation tramways had issued a notice to the employés with regard to the National Insurance Act, in which he stated that he was very clearly of the opinion that the men should not select any society, no matter how first-rate it may be, which had anything whatever to do with politics or trade unionism; and if so, whether he proposed to take any steps to secure to the employés their right of selection to an approved society. Mr. Masterman replied that it was both the clear intention of the Act, and in itself very desirable, that insured persons should have absolute freedom in the choice of their approved society. He had no legal power, however, to prevent such circulars being issued as those described in the question.

A further batch of documents relating to the Act have been issued. They give a summary of the "unemployment" part of the scheme, which comes into operation on July 15th, and directions to employers in respect thereto. By the date named every workman in the scheduled trades must obtain an unemployment book issued by the Board of Trade, and every employer must obtain an unemployment book from every such workman in his employ on that date, and from every such workman whom he may afterwards employ. Applications for these books may be made on and after June 1st at a Labour Exchange or other local office of the Unemployment Fund, where information as to rates of benefits and contributions may be obtained.

Petrol-Electric Sets for Wireless Telegraphy.—In consequence of the recent *Titanic* disaster, the ASTER ENGINEERING CO., LTD., are receiving a large number of inquiries for their petrol engines directly coupled to alternators, for supplying the necessary current to enable the wireless telegraph apparatus on board ships to work, in the event of a mishap, up to the very last moment, in spite of the main engines and other machinery having been stopped. These sets can be started up at a moment's notice, and are very similar to a large number which they have already supplied to the Marconi Co. for land work.

Meters Approved.—It is notified in the *London Gazette* that the Board of Trade has approved of the Ferranti A.C. and C.C. prepayment electricity meters, deposited by FERRANTI, LTD., in August, 1909.

THE ENGINEER AND THE CLERK—A STUDY IN RELATIVE VALUES.

By H. E. GOODY.

We are in the twentieth century, and every class of business is supposed to be conducted on a strictly utilitarian basis. Nothing that is not absolutely immoral (and sometimes even that exception is not made) is, one might have imagined, permitted to stand in the way of profit and general efficiency. It is, indeed, true that we have scrapped every decent form of business sentiment, and parted with nearly every courteous tradition in our modern hurry and bustle.

But, as a matter of fact, we still retain an absurd and humiliating tradition that is at once a bar to efficiency, and a source of irritation to competent and self-respecting employés. I refer to the ridiculous distinction which is made between the engineer and the mechanic on the one hand, and the clerk on the other.

This distinction, which, it is almost unnecessary to say, is in favour of the clerk, is a common feature of the administration of all engineering undertakings; but it will, perhaps, give more point to the argument if we confine ourselves to the consideration of this matter in relation to the supply of electricity.

In central stations this clerical domination is more pronounced than anywhere else; and especially so in those stations which are under municipal management. In any engineering business the office should be quite a subordinate department; but, in some curiously illogical way, the clerical staff, while still receiving pitifully small salaries, as compared with the engineer and the skilled mechanic, have got themselves raised to a status where, without money, wit, or skill, they impertinently rule the more intelligent workers. How this state of things originated it is hard to say; and how in the world such a blatantly idiotic piece of inconsistency gained almost universal recognition and acquiescence is impossible even to surmise.

Thus it comes about that at a certain generating station the list of staff members includes a junior clerk, at a salary —*salary*, mark you!—of £40 per annum, but totally ignores the existence of the meter superintendent, who draws a *wage* of £2 10s. per week.

The junior clerk is always referred to as Mr. Harvey, the meter superintendent is always known as Brown. Three committee meetings and a full council meeting had to be held, before the clerk could be appointed to his onerous and important post. Brown was engaged directly by the chief engineer as a weekly servant; and, so far as the committee is concerned, he is only one amongst a hundred workmen who are not on the *staff*.

Now, Brown is a well-educated man; he has received a good mechanical training at works and college, and, moreover, he is a trifle sensitive. He feels that he is a more important worker and more essential to the efficient conduct of the station than the gentleman who spends his time licking stamps and copying letters. As a proof, our meter expert will point out that he is paid nearly twice as much as any clerk in the place; and very naturally he resents the implied slight which is contained in his exclusion from the roll of the established staff.

This is merely one instance of clerical predominance. Hundreds of others might be adduced.

In another central station, for example, until quite recently, the charge engineers and the assistant mains superintendent were "unestablished," and the office boy took precedence over them. It was only after years of quiet agitation that these men were able to get their positions officially recognised; and even now their names come last (the office, of course, being first) in the staff list published in the Borough Council's official handbook.

One may say that these things are empty honours, and that such trifling points of dignity are not worth making a fuss about; but you can't get over an obvious injustice by telling the victim that he is worrying himself over nothing, for he will naturally retort, if the honour is really empty, and the dignity truly inconsiderable, why not relieve the clerical staff of such embarrassing superfluities?

Not only does this condition bear hardly upon the technical side of supply undertakings, but it also spoils clerks, who would otherwise be quite tolerable persons. It gives them an exaggerated idea of their own importance, and encourages them in a brusquely impertinent manner towards men who, although only engineers, are earning treble their own salary.

It is my experience that where there is any friction and unpleasantness in the working of a central station, it is, in nearly every case, due to clerical presumption. The relative positions of clerk and engineer, as they exist in central stations to-day, are so manifestly absurd that one can only wonder at their persistence. One would think that in a commercial undertaking, where the size of a man's salary is the only criterion of worth, the 25s.-a-week clerk would be taught to look with respect upon the skilled mechanic earning £2 10s., or the assistant engineer with £3 or £4 per week. But the contrary theory seems to prevail; and in default of a decent salary, the genteel scribe is (by way of compensation) called "Sir," and paid monthly.

Of course, one cannot blame the clerks for these conditions; they have naturally taken advantage of the tendency to exalt their own class. But in their lust for power, it would be well for them to reflect that, after all, in a generating station, the men who actually generate and distribute electricity are of first importance, and the clerical function is the subsidiary and somewhat menial one of keeping records of work done and money spent.

If there is any blame, it must be borne by the chief engineer and committee who permit this incongruity. It is in the power of these high authorities to lower the status of the clerk and to raise that of the engineer and mechanic. Such a reversal of positions would be merely an act of justice; and if it be denied on the ground that there is no general demand therefor on the part of the men affected, one can only say that the reason for this apparent acquiescence is simply that the average Englishman is so mortally afraid of making himself ridiculous, that he would often rather go without something he greatly desired, and which he could have for the asking, than run the smallest risk of being laughed at.

The matter, if it is to be set right at all, must be set right from the outside; and it must be done as a voluntary act of grace, for it will never be demanded.

NOTES FROM INDIA.

[From our special correspondent.]

Hyderabad, Deccan.—There is considerable engineering activity in this native State since the young Nizam succeeded his father. The electrical engineer to the State has recently been home, and has, it is said, ordered a complete equipment for a large extension of the old lighting station. Messrs. Callenders, Siemens and Osler's have got a fair share of the orders for cables, plant and palace wiring respectively.

Indian and Eastern Engineering says that the Indian Government has granted a concession for the utilisation of the Upper Jumna for the generating of electricity for lighting New Delhi. The site proposed for the new power station is 180 miles above Delhi on the river. The first installation is to be of 5,300 kw., and the transmission line to be 140 miles long.

Simla.—This hydro-electric scheme is gradually approaching a finish, and the end of this year should see its completion. Tenders may be called for street lighting, and house wiring work will be brisk.

Shillong.—The provincial Government has again begun to move in the matter of an electrical installation for this hill station. House owners and occupiers are being canvassed to find out what load can be guaranteed. There is

plenty of water power available in the vicinity. Shillong being close to Cherapoongee, said to be the rainest district in the world, Government would probably grant a lighting and power concession to any person or body willing and enterprising enough to come forward.

Accumulators in India.—A point which often puzzles engineers in charge of batteries in India is, what influence extremes of temperature have on the life of a set of accumulators. The regulation instruction card comes out with each set imported, and the particulars given therein are obviously intended for cool climates only. Acid is seldom or never imported from home on account of freight and certain shipping prohibitions. It is usual, therefore, to order acid locally giving the specific gravity suitable to the particular type of accumulator to be used. Now, of course, a specific gravity of, say, 1,215° at 60° F. becomes very much reduced when the temperature is, say, 110° F., and an engineer is frequently puzzled as to how to act. In extremes of temperature, say at Delhi, a battery room may be 60° F., or less in cold weather, and in hot weather it may be 120° F. or more. The point which wants clearing up is, with these extremes in view, at what specific gravity should acid be put into cells. The life of a battery in India and on the plains is notoriously short, and whether this is due to (1) extremes of temperature and consequently varying specific gravities; (2) impure acid; (3) impure water; (4) native carelessness, or a combination of all four, remains yet to be discovered. Perhaps someone experienced in battery manufacture might write his views for the good of his exiled electrical brethren in India.

AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYÉS.—IV.

During an interval in the hearing of the case brought by the Australian Tramway Employés Association against the various tramway companies for improved conditions referred to in our issue of May 3rd, judgment was given by the same Judge, Mr. Justice Higgins, in another case bearing on the question. It seems that an application had been made in the Third Civil Court by four workmen to have the registration of the men's Trade Union—the Australian Tramway Employés Association—cancelled. This application was dismissed by the Judge, who first of all expressed his doubts as to whether the nominal applicants were really the real agents in the matter. *Primâ facie* they had sufficient interest in the matter to make the application. They had all been members of the Association, though most of them had resigned. They were bound, however, by the rules that no resignation could take effect for six months, so that, while disagreeing with the policy of the Union, they were unable for that period to free themselves of responsibility and liability. The Judge pointed out that while some of the rules appeared drastic, such as the apparently unlimited power to fine members—no stipulation being directly made that the fines must be reasonable in amount—the obligation to continue in membership for six months after giving notice of resignation, and the power of the Executive to prevent any member making copies from the Association's books, yet they did not in themselves render the registration of the Association invalid, though he did not think all of them quite reasonable.

On the resumption of the Arbitration Court case on April 1st, the conditions of service in Perth, Western Australia, were inquired into. Mr. Dewsnap, the President of the men's Union, stated that for 18 months he had been paid 10¾d. per hour, then for a further 18 months 11¼d. per hour, and he was now receiving 1s. per hour. The amount claimed was 11s. per day plus 15 per cent. This addition was asked for owing to the high cost of food as compared with other States. They had had a number of disputes with the Tramway Co., and in 1910 struck from July 20th till September 10th. Previous to this an appeal had been made to the Arbitration Court of Western Australia, who had issued an award giving minimum rates, which the men resented owing to the company reducing all wages to the minimum standard. At the present time 130 out of 142 employés were members of the Union. While they did not make any general charge against their employers, there were several things they wanted altered. They asked for time taken in paying in money to be included in the time worked, the right to travel free on the cars, and the other points included in the claim under discussion. Mr. Keating then gave evidence on behalf of the Freemantle employés. Considerable discussion took place as to the disappearance from the branch minute-book of the pages recording the adoption of the claim. Mr. Keating, although secretary, could not explain the mutilation of the book. He could only remember the acceptance of the claim as sent to them from Melbourne. When asked if he was aware that under one clause of the claim men would be entitled to 7s. 11d. per hour, he said the branch did not want that. He knew that under another clause men could get 38s. for a day's work, but thought the company would find means to prevent it being done. He did not consider £2 13s. 4d. per week a living wage in Western Australia. He considered the work of both motormen and conductors very tiring. Asked as to whether the Association expected the company to dismiss any of their members whom they turned out of their ranks, the witness admitted that if a man tried to injure their Union they would refuse to work with him, and in this way bring pressure to bear on the company to dismiss him, too.

The position at Brisbane was then inquired into. To some extent this evidence repeated that given in another Court in connection with the case brought to compel the Tramway Co. to allow their employés to wear the Union badge.

Mr. Brandon, an ex-motorman, described the efforts made at various times to form a Trade Union, and the steps taken by the company to defeat this.

Mr. Jessop, another ex-employé, stated that special efforts were now being made that new employés should not be members of the Association. In fact, Mr. Badger, the manager, was altogether opposed to their Association. After giving a case where an employé, who was purchasing a house, was advised by the company to leave the Union—a course the man declined to do without any dismissal following—the witness stated that if a member of the Association broke any of the company's rules and regulations, he was more severely dealt with than if he were a non-member.

The discussion then turned to the paragraph in the claim demanding "That preference shall be given to members of this organisation, other things being equal." Mr. Jessop was asked what he understood by the phrase, but beyond admitting that character ought to have something to do with it, he was unable to give any information.

Mr. Prendergast, the men's leader, stated that they wanted a judicial finding as to the meaning of the term, and that until they got it they could hardly argue it. He would say, however, that "If the company want to have the wheels run smoothly, they should have inspectors who are pleasing to the men."

The claim that all cars should be fitted with air brakes was mentioned, and, referring to Adelaide, it was stated that it would cost £30,000 to fit them to the cars.

Mr. Ovenden, of the Adelaide tram service, was then recalled, and to test the statements made as to the demands made upon motormen, the judge was invited to personally inspect the cars and examine the appliances provided. As one ground on which the demand for high wages was made, Mr. Ovenden stated that a motorman was held to be responsible for his car, and, if damage was done to it, he had to pay. He ought, therefore, to be paid a sufficiently high salary to permit him to provide a sinking or an insurance fund for this purpose. Asked what proportion of the 11s. a day asked for would be devoted to that purpose, witness could not say. Mr. Goodman, the manager of the Tramway Co., said that at Adelaide in three years they had paid £166,144 in wages, and deducted £5 11s. 6d. for damage to cars.

The further hearing of the case was adjourned.

Wotans and Tantalums.—We understand that the Central London Railway have replaced the whole of their arc lamp installation for station lighting with Siemens "Wotan" drawn tungsten wire lamps in Holophane fittings specially designed for the purpose. We gave an illustration of one of the stations so lighted a few months ago. Altogether there are some 500 light points. We learn that at a recent discussion on railway lighting at the Society of Illuminating Engineers, this system came out very efficiently for station lighting, the illumination curve being almost a straight line. Tantalum traction lamps are about to be installed on another well-known East London tramway. These lamps are now installed on nine-tenths of the London tramway systems, and 20,000 are actually in use on the L.C.C. cars alone. We are also informed that Siemens tantalum traction lamps and "Wotan" lamps in Holophane fittings are to be installed on a London electric railway station which is to be open shortly. The new Liverpool Street Arcade is illuminated with Siemens "Wotan" lamps. This arcade is considered one of the finest in England, and special attention has been paid to the illumination scheme.

Trade with Belgium.—We have received from Brussels a copy of the second annual report of the British Chamber of Commerce in Belgium, for the year 1911. It refers to a number of matters of general interest to traders, and gives a list of members and their addresses. In the appendix there is a note for British firms seeking to do business with Belgium, based upon the observation by the Chamber of the defects of English ways of doing business, as compared with those of Continental rivals. The following advice is given to British firms:—(*a*) Appoint British representatives or agents who speak the language (French) fluently, and who are in sympathy with the inhabitants. (*b*) Send out all catalogues and other printed matter in the language of the country, with quotations, measurements and weights in French. Many foreign firms quote *à domicile*, a great advantage when dealing with the Continent. (*c*) Find out what goods are most wanted before sending out travellers with samples not adapted to the requirements of the country. "If more attention were paid to these points we are sure that a large part of the import trade of Belgium which now gets into the hands of our more watchful neighbours might be obtained by British firms. The present is no time for lethargic indifference."

TRADE STATISTICS OF EGYPT, 1911.

The following statement, showing the imports of electrical and similar goods into Egypt during the year 1911, is taken from the recently issued trade statistics. The figures for 1910 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1910. £E.	1911. £E.	Increase or decrease. £E.
Steam engines, including boilers, &c.—			
From Great Britain ...	70,000	91,000	+ 21,000
„ Germany	8,000	15,000	+ 7,000
„ Belgium	1,000	1,000	—
„ France	2,000	5,000	+ 3,000
„ Greece	1,000	—	— 1,000
„ Holland	3,000	5,000	+ 2,000
„ Italy	6,000	8,000	+ 2,000
„ Switzerland ...	3,000	4,000	+ 1,000
„ Austria-Hungary...	2,000	3,000	+ 1,000
Total ...	96,000	132,000	+ 36,000
Electric machinery (including gas engines and petrol engines).—			
From Great Britain ...	52,000	62,000	+ 10,000
„ Germany	23,000	32,000	+ 9,000
„ Austria	1,000	2,000	+ 1,000
„ Belgium	7,000	3,000	— 4,000
„ United States ...	1,000	2,000	+ 1,000
„ France	14,000	8,000	— 6,000
„ Italy	4,000	13,000	+ 9,000
„ Switzerland ...	11,000	28,000	+ 17,000
Total ...	113,000	150,000	+ 37,000
Other machinery (except agricultural).—			
From Great Britain ...	71,000	116,000	+ 45,000
„ Germany	23,000	41,000	+ 18,000
„ Austria	2,000	3,000	+ 1,000
„ Belgium	3,000	3,000	—
„ United States ...	26,000	48,000	+ 22,000
„ France	24,000	37,000	+ 13,000
„ Italy	4,000	4,000	—
„ Switzerland ...	3,000	10,000	+ 7,000
„ Turkey	1,000	2,000	+ 1,000
„ Other countries ...	1,000	1,000	—
Total ...	158,000	265,000	+ 107,000
Railway and tramway carriages.—			
From Great Britain ...	55,000	1,000	— 54,000
„ Austria	—	19,000	+ 19,000
„ Belgium	34,000	11,000	— 23,000
„ France	5,000	—	— 5,000
Total ...	94,000	31,000	— 63,000
Lamps of all kinds.—			
From Great Britain ...	8,000	8,000	—
„ Germany	20,000	24,000	+ 4,000
„ Austria	28,000	36,000	+ 8,000
„ Belgium	3,000	—	— 3,000
„ France	7,000	7,000	—
„ Italy	—	1,000	+ 1,000
„ Sweden	11,000	10,000	— 1,000
„ Turkey	1,000	—	— 1,000
„ Other countries ...	3,000	3,000	—
Total ...	81,000	89,000	+ 8,000
India-rubber and gutta-percha, raw or manufactured.—			
From Great Britain ...	7,000	7,000	—
„ Germany	13,000	15,000	+ 2,000
„ Austria	4,000	7,000	+ 3,000
„ France	13,000	13,000	—
„ Italy	5,000	4,000	— 1,000
„ Switzerland ...	1,000	—	— 1,000
„ Belgium	1,000	1,000	—
„ Other countries ...	—	2,000	+ 2,000
Total ...	44,000	49,000	+ 5,000
Electric, telegraphic and telephonic apparatus.—			
From Great Britain ...	52,000	50,000	— 2,000
„ Germany	19,000	22,000	+ 3,000
„ Austria	20,000	19,000	— 1,000
„ Belgium	12,000	11,000	— 1,000
„ United States ...	1,000	1,000	—
„ France	19,000	20,000	+ 1,000
„ Italy	3,000	2,000	— 1,000
„ Sweden	5,000	7,000	+ 2,000
„ Switzerland ...	3,000	6,000	+ 3,000
Total ...	134,000	138,000	+ 4,000
Scientific instruments.—			
From Great Britain ...	19,000	19,000	—
„ Germany	17,000	20,000	+ 3,000
„ Austria	2,000	2,000	—
„ United States ...	1,000	2,000	+ 1,000
„ France	14,000	14,000	—
„ Italy	1,000	2,000	+ 1,000
„ Switzerland ...	1,000	1,000	—
Total ...	55,000	60,000	+ 5,000

£E = £1 0s. 6½d.

A New Method of Testing High-Pressure Cables when Laid.—It is very important that high-pressure cables should be tested after laying, but to test 1 or 2 km. or more of cable at 10,000 volts requires a large and heavy apparatus, if the old transformer method is adopted; further, a given transformer is only suitable for a comparatively narrow range of testing pressures. Methods have recently been advanced by Messrs. Delou and Picou whereby cables may be tested by direct current. The great loss of power in continually reversing the charge of the cable is thus avoided, but it is extremely difficult to determine what D.C. pressure is equivalent, for testing purposes, to a certain A.C. pressure. Experience shows that the ratio between the pressures depends on many factors, including the nature and thickness of the dielectric, the supply frequency, and so on. The D.C. "equivalent" of a given A.C. pressure cannot be determined with sufficient accuracy to be fair to the conflicting interests of manufacturer and client.

At the last meeting of the Soc. Int. des Electriciens, M. A. Léauté described a new means whereby cables can be conveniently tested under the conditions in which they are subsequently to be used. The principle employed is the interposition of an inductance between the cable and an alternating pressure of constant value. The value of the inductance is such as to make the test circuit resonate at the fundamental frequency of supply. A sectional inductance coil is easily adjusted to suit a very wide range of cable capacity, and it is easy to show that the number of turns required is less than the number of secondary turns in a transformer giving the same testing pressure (say, twice working pressure), assuming the same core flux density in each case. Actually, the transformer will usually work at a lower flux density, and, allowing for this fact, and the weight of the primary winding of the transformer, the advantage is very considerably in favour of the new resonance method.

The magnetic circuit of the inductance coil described by M. Léauté consists of two cylindrical uprights, 9 cm. diameter, 557 cm. high, built of enamelled iron wire, and weighing 40 kg. each. Two rectangular yoke bars, 10 cm. × 10 cm. × 81 cm. long, are built of insulated laminations, and weigh 55 kg. each. The four core sections can be transported separately; when in use, the lower yoke piece rests on an oak platform, and the upper yoke is bridged by a recessed oak cross-beam held down by long bolts (covered with ebonite tubes), between it and the platform.

Each vertical core receives 10 winding-sections, each 60 cm. in diameter, and carrying 500 layers of one turn each. Each turn is insulated from its neighbours by mica, held in place by shellac, and the whole is mounted in ebonite. The conductor consists of a strip of foil, 4 mm. wide and 0·1 mm. thick—a form which provides a strong coil with a large cooling surface and allows of a high current density. In the latest models the sections are regulable, to ascertain the resonance point without switchgear, and all the necessary measuring instruments are self-contained, so that only four connections have to be made—two to the supply and two to the cable. At present three sizes are built, viz., 0-50, 50-200, and over 200 KW.; all are capable of handling in transport and use by one man.

Among the advantages of the new method may be enumerated:—(1) The test is made by A.C. and under working conditions. (2) By distributing the coil sections in the outgoing and incoming leads, there is avoided all the inconvenience of earthing one terminal of the secondary, as is necessary when using a transformer to test between the cores and sheathing of the cable. (3) In case of breakdown during the test, the high inductance of the testing coil prevents the propagation of high-frequency oscillations. Also, the breakdown removes part of the capacity from the circuit, and thus destroys the resonance hitherto existing; the voltage on the cable then falls to normal, and the current, while remaining high enough to burn out the fault, is not sufficiently strong to injure the sound portions of the cable.

The method has already been applied to the testing of lengths of cable from 250 to 2,800 m. at pressures from 12,000 to 23,000 volts, and more elaborate and severe tests are in progress.

Standards for Lighting.—In the Parliamentary Papers, in reply to questions on the subject of standards of illumination, Mr. McKenna said that the matter had been under the consideration of his department for some time past, with reference both to the recommendation of the Accidents Committee and also to the work which was being done on the Continent in the matter, and preliminary investigations had already been made. The questions involved were very complex and technical, and he proposed in the near future to appoint a Departmental Committee of an expert character to report on the subject.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

11,302. "Starting mechanism for petrol motors or other internal combustion engines." W. Mycock. May 13th.

11,306. "Switchboard connection cords and the like." P. P. Craven. May 13th.

11,311. "Sparking plugs." C. E. Johnson. May 13th.

11,359. "Portable electric battery lamps." B. Pordes. May 13th.

11,366. "Electrolytic valves or polarisation cells." G. Liebe. (Convention date, May 31st, 1911, Germany.) May 13th. (Complete.)

11,372. "Portable electric battery lamps." B. Pordes. May 13th. (Complete.)

11,380. "Manufactnre of electric resistance bodies." G. Cooper. May 13th.

11,388. "Means for starting internal combustion engines (more especially those of motor-cars or the like), and for generating electricity for lighting or other purposes." W. H. Scott. May 13th.

11,406. "Electrical insulating compound." F. B. Ellis, E. Reeve and J. P. O'Neill. May 14th.

11,415. "Electric imitation candles." G. H. Roberts and E. Gawkroger. May 14th.

11,420. "Reflecting camera lucida for use with X-ray photographs." W. Cotton. May 14th.

11,434. "Repulsion motor with divided stator winding." M. Oerlikon. (Convention date, May 26th, 1911, Germany.) May 14th. (Complete.)

11,455. "Manufacture of metallic filaments for incandescent electric lamps." J. A. Scoular. May 14th.

11,464. "Impulse transmitters for semi-automatic telephone systems." Siemens & Halske-Akt. Ges. (Addition to 10,444/1912. Convention date, May 16th, 1911, Germany.) May 14th. (Complete.)

11,466. "Electric control systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) May 14th.

11,476. "Electric signals." A. C. Brown. May 14th.

11,479. "Alarm devices for use with wireless telegraph systems." W. H. Shephard and A. E. McKechnie. May 14th.

11,482. "Construction of electrical resistance devices." H. S. Martin. May 14th.

11,486. "Method of and means for controlling electric circuits." G. C. Pillinger and L. Sunderland. May 14th.

11,488. "Electric furnaces." C. Dellwik. May 14th.

11,501. "Compartment gas or electric cooking apparatus." S. A. Wieland. May 14th.

11,537. "Remote control for electrically-operated apparatus." W. P. Thompson. (Ateliers de Construction Electriques de Charleroi, Belgium.) May 15th. (Complete.)

11,557. "Electric starting apparatus for internal combustion engines." C. A. Vandervell and A. H. Midgley. May 15th.

11,559. "Distribution of electric energy." E. G. Waters. May 15th.

11,560. "Means for and methods of clearing faults on alternating-current systems." A. M. Taylor. May 15th.

11,578. "Telephones." R. Lagus. May 15th. (Complete.)

11,581. "Method for opening and shutting alternatively several contacts in a very rapid manner." L. E. Gabrilovitch and W. S. Dschanpoladoff. May 15th.

11,582. "Method of wireless multiplex telegraphy including the independent tuning of each of several receivers connected with one antenna." L. E. Gabrilovitch and W. S. Dschanpoladoff. May 15th.

11,584. "Electric-current distribution system." E. Bloustein. May 15th. (Complete.)

11,586. "Electric switches." P. V. Hunter and W. L. Shand. May 15th.

11,597. "Systems of electrical distribution wherein direct-current motors are employed." S. Eckmann. May 15th.

11,604. "Telegraph systems." E. Pope. May 15th. (Complete.)

11,605. "Telegraph apparatus." E. Pope. May 15th. (Complete.)

11,635. "Electrical generators." R. J. Lewis. May 16th.

11,668. "Electric furnaces employed in the manufacture of calcium carbide and products of a like character." C. Bingham. May 16th. (Complete.)

11,671. "Method of simultaneous transmission and reception of several wireless dispatches from one antenna." L. E. Gabrilovitch and W. S. Dschanpoladoff. May 16th.

11,701. "Electric bells, indicators and domestic telephones." S. A. Bhisey. May 16th.

11,702. "Starting apparatus for induction motors." A. B. Stratford. May 16th.

11,703. "Method of indirect excitation for oscillatory circuits." E. Girardeau. (Convention date, May 17th, 1911, Germany.) May 16th. (Complete.)

11,714. "Wireless telegraphy or telephony." H. Merton. May 16th.

11,779. "Junction boxes and the like for electric cables." J. W. Hogg. May 17th.

11,792. "Electrodes for arc lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) May 17th.

11,824. "Homopolar dynamo-electric machines." P. Hynes. May 18th.

11,842. "Economisers or shields for multiple arc lamps." Ges. Fur. Maschinen und Metall Industrie m.b.H. (Convention date, May 19th, 1911, Germany.) May 18th. (Complete.)

11,849. "Electric flash boiler-water heater." J. Mann. May 18th.

11,858. "Receiving and transmitting apparatus for wireless signalling." Londrome Syndicate, Ltd. (L. Gallotti, France.) May 18th.

11,869. "Telephone transmitters." Londrome Syndicate Ltd. (L. Gallotti, France.) May 18th. (Complete.)

11,870. "Vapour electric apparatus." E. E. Darmois and M. A. E. Leblanc. May 18th.

11,871. "Regulation of electric installations." H. D. Earl. May 18th. (Complete).

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Carbon Electrode for Galvanic Batteries, in which the Electrolytic Fluid or the Depolarising Gas or the Mixture thereof is conveyed through the Pores of the Negative Electrode. S. Benko. 9,649. April 20th.

Relay Device. A. Orling and Orling's Telegraph Instruments Syndicate. 10,105. April 26th. (Cognate application No. 13,984 of 1911.)

Method of Connection of Lines in Automatic Telephone Exchanges. Welles & Zwietsch. 10,238. April 27th. (April 27th, 1910.)

Controllers for Electric Motors. J. E. Brown. 10,364. April 28th.

Incandescent Electric Lamps and the Mounting of Same for Illumination, Advertisement and the like Purposes. J. Hubers. Berliner-Siriuslampen-Vertriebs Ges.) 10,433. April 29th.

Electric Lamp Shades, Screens or the Like. J. H. Winter. 10,375. April 29th.

Means for Fastening Incandescent Electric Lamps to Sheet-Metal Disks. J. Hubers. (Berliner-Siriuslampen-Vertriebs Ges.) 10,434. April 29th.

Holders for Electric Incandescent Lamps. J. Hubers. (Berliner-Siriuslampen-Vertriebs Ges.) 10,435. April 29th.

Military Searchlights. Sir A. T. Dawson and G. T. Buckham. 10,539. May 1st.

Means for Suspending Electric Lamp Fittings. J. Salmon. 10,728. May 4th.

Apparatus for Operating Electric Motor Controllers and the Like from a Distance. J. A. Hirst and P. S. Brook. 11,045. May 6th.

Ships' Telegraphs. P. R. Keppie. 14,108. June 14th.

Contact Conductors of Electric Traction Systems. W. D. B. Duddell and G. W. Partridge. 15,597. July 5th. (December 23rd, 1911.)

Automatic Control of Dynamo-Electric Machines in Direct-current Distributing and Consumption Systems. W. F. Grafton and E. P. Prior. 16,007. July 10th.

Spark Plugs. J. W. Mackenzie. (Champion Ignition Co.) 16,497. July 17th.

Telephones. B. Gwozdz. 19,011. August 24th. (June 17th, 1911.) Addition to 11,284/11.

Machines for Generating Electricity and Machines Driven by Electricity. R. Boyd. 19,160. August 26th.

Method and Apparatus for Electrically Producing Hollow Bodies from Arenaceous Quartz and other not easily-fusible Materials. A. Voelker and V. Meurer. 19,648. September 4th.

Vehicle Lamp for the Simultaneous Use of an Electric Light and an Oil or other Burner. C. Hurford. 26,014. November 21st.

Electric Clocks. H. W. Lake. (Electric Clock Co.) 26,168. November 22nd.

Incandescent Electric Lamps. R. Jahoda and Elektrische Gluhlampen Fabrik "Watt" Scharf Loti & Latzko. 27,388. December 6th.

Means for Guiding the Electrodes of Electric Arc Lamps. Siemens Schuckertwerke. 27,699. December 9th. (December 10th, 1910.)

Method and Device for Polarising Magneto-Electrical Machines. E. Volkers. 28,715. December 20th. (January 3rd, 1911.)

Electric Furnace. A. Helfenstein. 29,126. December 27th. Addition to 17,650/11.

Controlling Means for Electric Circuits. British Thomson-Houston Co. (General Electric Co.) 11,350. May 10th.

Machines for Pasting Storage Battery Electrodes and other Articles. H. C. Lake. (United States Lighting and Heating Co.) 11,516. May 11th.

Electrical Coupling Devices. R. Day. 14,179. June 23rd.

Secondary Storage Batteries or Electrical Accumulators. O. Oldham. 15,453. July 3rd.

Method of Manufacturing Metallic Filaments or Bands to be used particularly in Connection with Thermic Telephones. B. Gwozdz. 15,544. July 4th.

Spark Plugs for Use in Internal-Combustion Engines. G. C. Davis. 17,463. August 1st.

Electrical Conductors. B. A. Pilkington. 18,908. August 23rd.

Spark Plugs. G. Wright. 19,685. September 4th.

Method and Means for Transmitting Human Speech and other Sounds through Space. H. Manders. 21,116. September 25th.

Apparatus for Starting Multicylinder Internal-Combustion Engines. Robert Bosch (Firm of). 21,169. September 25th. (November 8th, 1910. Addition to No. 13,691 of 1910.)

Apparatus for Performing Work of Short Duration at Predetermined Times for Automatically Operating Gas Valves, Electric Switches and the Like. "Novitas" Fabrik Elektrischer Apparate Akt.-Ges. 24,034. October 20th. (October 29th, 1910.)

Electro-Magnetic Apparatus for actuating Electric Switches. Valves and the Like. J. P. Coleman. 24,154. October 31st. (November 2nd, 1910.)

Method for Securing the Diaphragm in the Cases of Microphones, Telephones, Gramophones and like Sound-reproducing Apparatus. W. P. Thompson. (Akt.-Ges. Mix & Genest Telephon- & Telegraphenwerke.) 25,491. November 15th.

Electrostatic Separators for Use in Purifying Flour, Grain, Rice and other Substances. J. L. Lawson. 28,782. December 21st.

1912.

Wireless Telegraphy Installations. W. P. Thompson, (Ges. fur Drahtlose Telegraphie.) 2,769. February 2nd.

Telephone Exchange System. P. Jensen. (Clement International Engineering Corporation.) 4,983. February 28th. (Divided application on No. 9,142 of 1911. April 12th.)

Couplings or Joints for Electrical Cables and the Like. C. J. Beaver and E. A. Claremont. 5,071. February 29th.

Telephone Exchange System. J. Jensen. (Clement International Engineering Corporation.) 5,876. March 8th. (Divided application on No. 9,142 of 1911. April 12th.)

Process for the Manufacture of Oils containing Colloidal Mercury. A. Dering. 1,219. January 16th. (February 11th, 1911.)

Vapour Alternating-Current Rectifiers and similar Apparatus. Hartmann and Braun Akt.-Ges. 2,471. January 30th. (February 3rd, 1911.)

Device for Securing Electric Conductors and the Like to Walls or other Supports. W. T. Henley's Telegraph Works Co. and A. J. Hedgcock. 2,649. February 1st.

Alternating-Current Electric Motors. A. C. Bell. 910. January 11th.

Rotary Apparatus for Electro-plating Small Articles. M. Hüttig. 4,127. February 19th.

Electric Arc Lamps. A. G. Way and C. E. G. Thorkelin. 4,365. February 21st.

Rectifier for High-tension Alternating Currents. Siemens & Halske Akt.-Ges. 7,467. March 27th. (March 27th, 1911.)

International Congress of Applied Chemistry.—No fewer than 683 papers have been definitely promised to the 24 sections of this Congress, which is to be held at Washington and New York on September 4th to 13th, 1912. Papers must be in the hands of the American Committee before June 30th, 1912, and membership in the Congress should be completed by all prior to July 1st, 1912, in order to receive the printed proceedings.